

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILDLIFE THROUGH EDUCATION"

VOLUME 30

SAN FRANCISCO, OCTOBER, 1944

No. 4

TABLE OF CONTENTS

	Page
In the Service of Their Country-----	220
The Prong-horned Antelope in California----- <i>Donald D. McLean</i>	221
The Fur Catch in California, 1940-1941----- <i>Howard Twining</i>	242
Editorials and Notes—	
Twenty-five Years Ago in "California Fish and Game"----- ----- <i>Brian Curtis</i>	247
In Memoriam—E. Clarence Moore-----	249
Reports -----	250
Financial Statements -----	252
Index -----	255

CALIFORNIA FISH AND GAME is a publication devoted to the conservation of wildlife. It is published quarterly by the California Division of Fish and Game. All material for publication should be sent to Brian Curtis, Editor, Division of Fish and Game, Ferry Building, San Francisco 11, California.

The articles published herein are not copyrighted and may be reproduced in other periodicals, provided due credit is given the author and the California Division of Fish and Game. Editors of newspapers and periodicals are invited to make use of pertinent material.

Subscribers are requested to notify the Division of Fish and Game, Ferry Building, San Francisco 11, California, of changes of address, giving old address as well as the new.

In The Service of Their Country

Now serving with the armed forces of the United States are the following 156 employees of the California Division of Fish and Game, listed in order of entry into the service:

J. William Cook	Howard Shebley	John M. Spicer
Merton N. Rosen	Donald Tappe	Wm. Longhurst
Albert King	Richard S. Croker	George Booker
E. L. Macaulay	J. G. McKerlie	J. Ross Cox
E. R. Hyde	Robert Kaneen	Harold Wilberg
George Werden, Jr.	Elmer Lloyd Brown	Leslie Edgerton
E. A. Johnson	Douglas Dowell	Arthur L. Gee
Henry Bartol	William Roysten	George Shockley
Edson J. Smith	Dean L. Bennett	Laurence Werder
John F. Janssen, Jr.	John Chattin	Robert McDonald
Richard Kramer	C. L. Towers	Frank L. D. Felton
Arthur Barsuglia	Carlisle Van Ornum	James A. Reutgen
George Metcalf	Arsene Christopher	David M. Selleck
James F. Ashley	Harry Peters	Chris Wm. Loris
William Jolley	Mark Halderman	James T. Deuel
Rudolph Switzer	John B. Buttler	Lionel E. Clement
Jacob Myers	Charles Comerford	Thomas Borneman
Charles McFall	Niles J. Millen	Richard Riegelheth
Lloyd Hume	Carol M. Ferrell	Willard Greenwald
John E. Fitch	J. Alfred Aplin	Carl G. Hill
William H. Sholes, Jr.	James E. Wade	H. S. Vary
James Reynolds	Nathan Rogan	Emil Dorig
Paul Gillogley	Henry Shebley	Donald Glass
Ralph Beck	S. Ross Hatton	Ruth Smith
Charles Cuddigan	Jack Wm. Cook	Wm. J. Overton
James H. Berrian	John J. Barry	Daniel F. Tillotson
Edward Dolder	Chester Ramsey	Earl S. Herald
John Woodard	Elmer Aldrich	Theodore Heryford
Bob King	Robert N. Hart	Ellis Berry
Ross Waggoner	Ralph Dale	Lawrence Cloyd
John Canning	James D. Stokes	Eleanor Larios
William Richardson	George D. Seymour	John Laughlin
William Plett	Glenn Whitesell	Ralph Classic
John Finigan	A. E. Johnson	Owen Mello
Trevenen Wright	Gustav E. Geibel	Gordon L. Bolander
John A. Maga	Wm. Bradford	John B. Cowan
Elmer Doty	Ernest E. McBain	Harold Erwick
William Dye	John Hurley	Bert Mann
Lester Golden	Karl Lund	Douglas Condie
Richard N. Hardin	Henry A. Hjersman	Andrew Weaver
Henry Frahm	Elden H. Vestal	Robert Fraser
Lawrence Rubke	Walter Shannon	Don Davison
Virgil Swenson	Jack R. Bell	William Payne
Harold Dave	Harold Roberts	Harley Groves
Howard McCully	Edwin V. Miller	Herbert Ream Merrill
Austin Alford	Phil M. Roedel	Frank Burns
Belton Evans	Chester Woodhull	Garrie Heryford
Willis Evans	W. S. Talbott	Robert O'Brien
James Hiller	Richard Bliss	Kenneth Doty
Robert Terwilliger	William D. Hoskins	Don Chipman
Eugene Durney	Edgar Zumwalt	Howard Twining
Charles W. Kanig	Earl Leitritz	Fred Ross

Billed in Line of Duty

THE PRONG-HORNED ANTELOPE IN CALIFORNIA¹

By DONALD D. McLEAN

Bureau of Game Conservation,
California Division of Fish and Game

The accepted scientific name of the prong-horned antelope, *Antilocapra americana* (Ord), dates from 1818 (Journal de Physiologie, LXXXVII, p. 149). An earlier name, *Antelope americana* Ord 1815 (Guthrie's Geography, 2d. Am. ed., II, p. 292, desc. on p. 308) was displaced by the former.

The genus name *Antilocapra* was compounded by Ord from the Latin *antilope*, meaning antelope, and *capra*, meaning goat. *Americana*, of course, means American. The genus has only one species.

Some other local names are prong-buck, prong-horn, antelope, and looper, which is English. Le cabrit is French-Canadian. Ah-pi-chee Ah-tik is Cree meaning small caribou, Tah-cha-chis-teen-ah is Yankton Sioux meaning small deer, and Ogallala Sioux is Tah-keen-cha Sanla meaning little pale deer. The Mexican term is berrendo meaning pinto.

The family *Antilocapra* is strictly North American and is peculiar in that it combines the features of several other families. It has two hoofs on each foot like the giraffe; a gall bladder similar to a goat; hair resembling that of a deer, with an undercoat of fine, woolly hair; and four teats. It has hollow horns on bony cores like a goat, but unlike the goat the external horn is shed each year.

The scent glands are numerous and are distributed as follows:

1 postmandibular	2
1 ischial	2
1 inter-digital	4
1 hock, present in pairs	2
1 median on lower back	1
Total	11

The general color and pattern of the pelage in the adult buck is a bright reddish tan with pure white on the sides of the head, breast, belly, rump, and the two front bands on the throat (Fig. 84). The patch under each ear, the top of the nose, and the mane are generally black. The entire animal has the appearance of being patched tan and white rather than spotted. The female appears similar except the black areas are less extensive and the tan is paler. The entire pelage is shed twice a year, once in the fall and again in the late spring.

The young are unspotted and are grayish brown at first, with a paler but not white rump and underparts. They acquire the adult colors early in the first autumn.

¹ Submitted for publication, July, 1944. All illustrations and maps by author.

Early Records

There are many records among the notes and logs of early explorers and travelers in North America. A few of these are listed below as seeming to be of worthwhile importance.

In 1540, antelope were described by Coronado.

In "Torquemada's Monarquia Indiana" published in 1723, a hunt was described as taking place in 1540 in southwestern Hidalgo in honor of the Viceroy Antonio Mendoza.

Lewis and Clark mentioned them in the annals of their trip westward in 1805 and 1806.

Bidwell used them as a source of food in 1841.

During the 1850's, John Converse shot antelope for the Stockton and San Francisco markets on the plains of the San Joaquin Valley where the City of Merced is now located.



FIG. 84. Adult buck antelope.
Lassen County. September 10, 1941

General Range of Prong-Horned Antelope

Originally antelope were found over a large part of western North America, principally on the high, open plains. In Texas and California, they ranged down to and even below sea level. The original range covered over 2,000,000 square miles and had an estimated population of 40,000,000.

During the latter part of the last century, the increased amount of fencing and agricultural development forced them to work more and more into the lightly timbered areas. Now it is not at all unusual to find antelope in open, yellow pine timber and relatively dense stands of juniper, especially if these are on plateau type terrain. The antelope, because it could more easily adjust itself to the changing conditions, survived after a hard struggle, whereas the equally numerous bison or buffalo failed.

Present Range in California

The present principal range of the prong-horned antelope in California is in the northeastern part of the state, as may be seen on Fig. 85. Lassen County has the largest number, followed by Modoc. Siskiyou has a fair number, and several smaller groups are to be found in Plumas, Shasta, and Sierra counties. The original range of the species

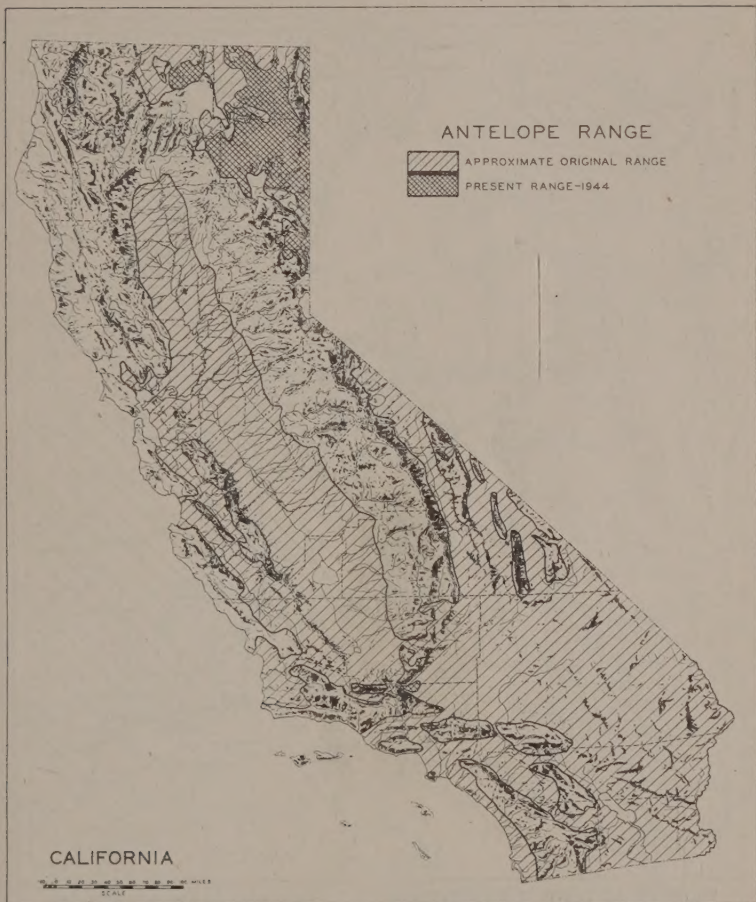


FIG. 85. Antelope range in California.

in this region has not as yet been repopulated, but this is gradually being accomplished as each year small bands invade new areas in the old habitat, sometimes to remain and in other instances to return again to the more heavily populated range. Such areas are Shasta Valley east of Granada, Siskiyou County; Hobart Mills, Nevada County; Mountain Meadows east of Westwood, Lassen County; Sierra Valley and vicinity in Plumas and Sierra counties; Hat Creek rim in Shasta County; and Dry Lake south of Stronghold in Modoc County. Apparently Shasta Valley, Hobart Mills, and Mountain Meadows are not permanently occupied as yet, but may become so. They do show that the antelope are gradually returning to their old range. Some of these movements were made in force, but in most instances the first animals were venturesome small groups or even singles.

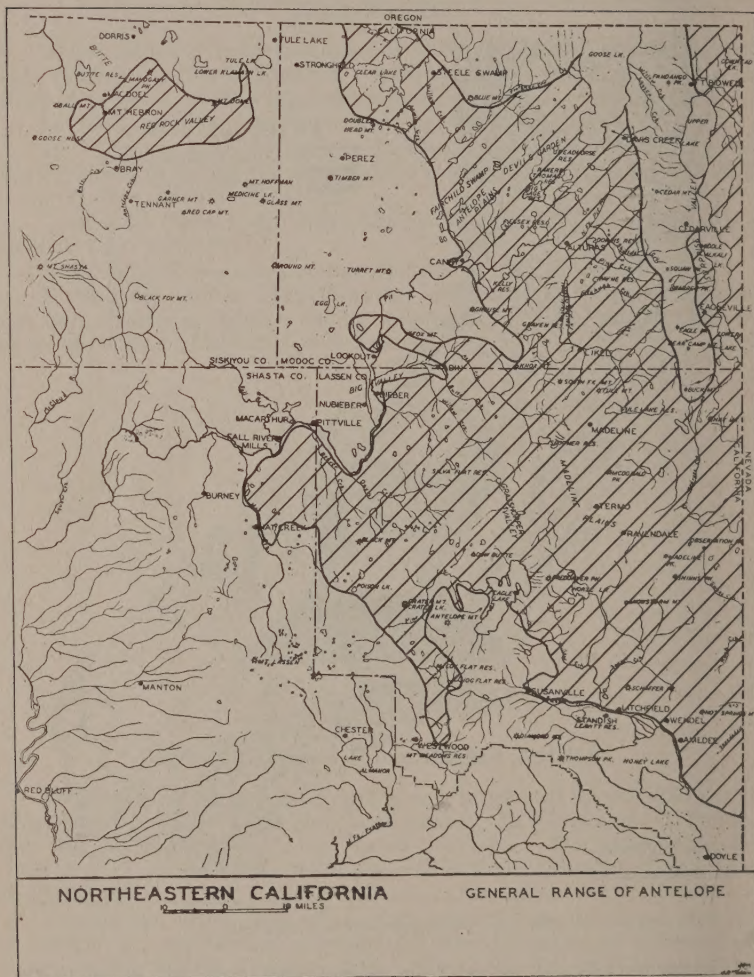


FIG. 86

Some of the incursions have necessitated the traversing of a considerable distance through timbered areas. More and more it has become evident that antelope are not averse to travelling through timber land even where it is quite heavy. They have been seen on a number of occasions well out in the open yellow pine and fir forests, particularly in that region northwest and west of Eagle Lake. In this area, it is often necessary for them to travel through timber to get from one open valley to another. Brushy cover is not to their liking and they make every effort to stay out of it, particularly if frightened.

The winter range in southeastern Lassen County is an irregularly shaped area north and east of Honey Lake Valley. It extends a few miles eastward into Nevada, north to the upper Smoke Creek Basin and Snowstorm Mountain, and south to the edge of Honey Lake Valley. This area harbors the largest number of antelope in the state during the winter.

Some antelope winter in Dixie Valley and Big Valley in northwestern Lassen County.

In Modoc County there are several winter range areas: the tableland lying east of the south fork of the Pit River between Alturas and Likely; the slope and edge of the tableland lying north of the Pit River from the Indian agency northeast of Alturas to near Canby; the easterly side of the north half of Surprise Valley in eastern Modoc County (in hard winters they apparently leave this range and go into Nevada); and along Lost River north of Clear Lake where a small number winter along the California-Oregon line.

The winter ranges in Siskiyou County and Shasta County lie within the summer ranges but are smaller due to the fact that snow forces the antelope to concentrate at lower elevations.

It seems from the evidence of the annual counts that the same herds of antelope winter in the same sections of the winter range year after year. Spot maps show this quite plainly. Each herd has a relatively small area over which it moves.

Migration in California

The antelope of Modoc and Lassen counties usually occupy their winter range from November to early or middle April. This varies some from year to year because of weather. Early storms hasten the autumn migration and spring storms retard the return to the summer range. There is a gradual break-up of the large wintering herds commencing in the latter part of February, and these smaller groups often begin a gradual drift in the direction of their summer range, although they may not actually leave the winter range for some time.

The journey to the summer range is ordinarily carried on in a more leisurely manner than the fall migration. However, one of the longest and, as far as I know, one of the fastest migration trips occurred in April, 1937, when a band of antelope moved from near Bull Flat in eastern Lassen County to near Hayden Hill in north central Lassen County, a distance of about 60 miles, in about 11 hours.

A map of the principal migration routes in the northeastern part of the state is shown on Fig. 88.

Antelope Highways

During their migration from summer to winter range and in travelling from one area to another on either the summer or winter range, antelope ordinarily move over definite and well established routes.

Antelope from various valleys will converge toward the main travel line and upon reaching it all take the same route toward their ultimate destination. Some of these antelope highways are so well worn that they show up plainly even during the seasons when no antelope

are using them. The trails are easily identified as those of antelope and not of deer. Deer go from one brush patch to another or from tree to tree, especially in the juniper area, whereas antelope keep to the open slopes and flats and their trails are much more direct and maintain a more even grade. Deer occasionally travel antelope trails, but antelope rarely travel deer trails. Antelope tend to keep together, often in single file, when traveling, whereas deer commonly spread out with stragglers along the sides of the band. Deer herds are always much more loosely knit than those of antelope.

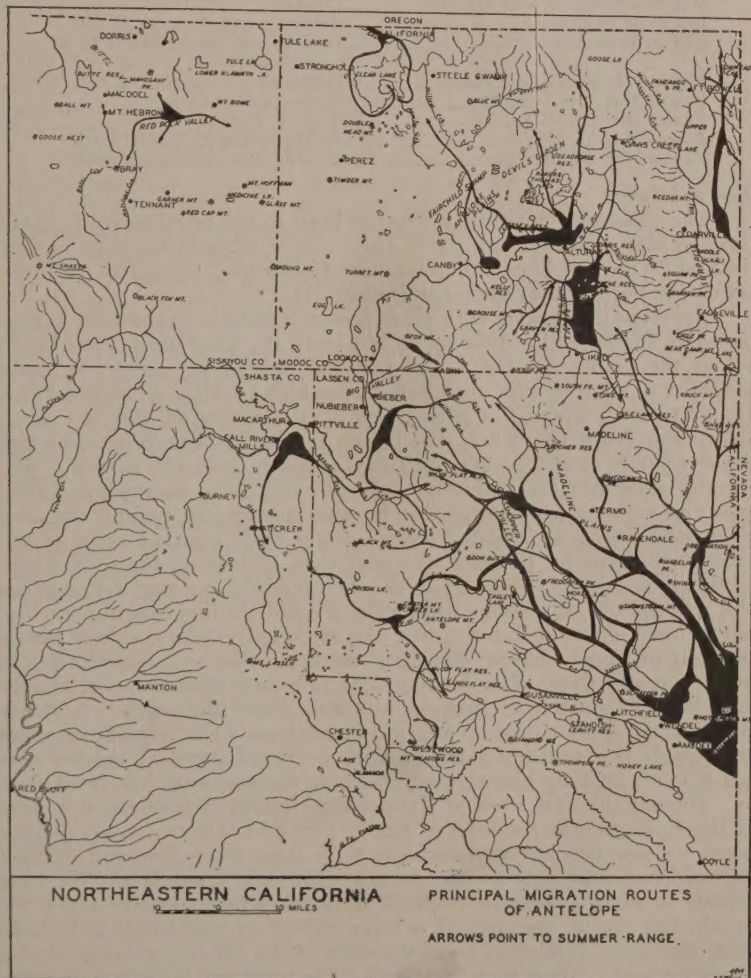


Fig. 83

Life History

Rutting Season and Gestation Period

In California, the rutting season begins in September and runs through October and part of November. The fawns appear from late April to mid-June, the bulk being dropped from May 5 to May 25. Apparently the gestation period is 7 to 10 days longer than that of deer, which is approximately 210 days.

Other data on the rutting season and time of arrival of fawns are presented below for the sake of comparison:

Rut September through October	Colorado
Rut early September	Arizona; and Sonora, Mexico
Rut in September	Central area (according to H. E. Anthony)
Fawns late May to early June	Colorado
Fawns May 1 to June 20	Northern Nevada
Fawns May 29, 1935	Alberta, Canada
Fawns May 31, 1927	In Milwaukee Zoological Park
Fawns May 26, 1928	In Milwaukee Zoological Park

Does and Fawns

The unspotted antelope fawns are born in the latter part of April, through May, and even into early June. Most of them are born during the first 20 days of May in northeastern California. One, two, or three fawns are born, the average being about $1\frac{3}{4}$.

Antelope does travel with other does and immature antelope during the early spring and ordinarily do not leave the band until a few hours before the young are born. At fawning time a doe generally seeks seclusion in an area with open, but rather high brush. After she drops her first fawn, which lies perfectly still, she moves off 100 feet or so before she drops the other, which also lies still. The youngsters are not ordinarily seen together until they can run with the mother. She remains close by most of the time, except when going to water and then goes and returns promptly. She browses and grazes around the area where the young are bedded down, giving their location away to the careful observer by pausing now and then to look at the spot where each one is located. She scans the surrounding country for enemies and will fight or, if possible, lead away a coyote or dog that approaches. She is very clever in intercepting the intruder, running slowly across in front of him to induce him to chase her. She will almost let him catch her and then, after leading him to a safe distance, will simply leave him flat-footed or turn on him and drive him away. A single coyote is not a match for an angry doe antelope. I have seen two cases of a single doe running a coyote with her head down at the coyote's tail tip and striking him at every possible moment with her front feet.

During the first week of June, 1942, Ramon Somavia and I were at Big Springs near the head of Smoke Creek in eastern Lassen County when we saw two antelope running with their heads low and darting forward now and then as they struck with their front feet. We were unable to see anything in front of them for some time because of the brush, but finally we spotted a large coyote in noticeably bad shape that was being belabored from the rear by an old doe antelope and a yearling buck. He was definitely in bad condition, as he was limping and appeared to be injured in the lower back. They went on out of sight over a ridge and in about 20 minutes both antelope returned.

During the winter when the antelope are in large bands, I have never noticed that they pay any particular attention to coyotes; in fact, they hardly get out of a coyote's way. Of course, if snow were deep it might be different, but antelope make every effort to keep out of such situations.

Eagles hunt for young antelope and are clever enough to perch near a doe and watch for the young. However, I have never seen one actually get a fawn as the doe was generally on the job as soon as the eagle soared out over the area. The does stand up on their hind legs and strike toward the eagle. Eagles also attack single adult antelope on occasion.

Does feeding near their young will occasionally walk toward a fawn and stop. Whether the doe makes any noise or not, I do not know, but as the doe stops the fawn will stand up and then immediately lie down. As soon as the doe sees it, she begins feeding again. I have observed this on a number of occasions.

When going to nurse the young she cautiously walks around, feeding as she goes, but gradually getting close to the fawn until finally she stops directly over it. It then gets up, takes its meal, and lies down again, while she either goes to the other fawn or goes off feeding. She spends very little time actually with the fawns.

The fawns have a plaintive bleat that does not carry very far. The does have a barking bleat when calling to the fawns which I have heard only twice. Once when I put a fawn to flight accidentally, he ran pell-mell on a circuitous course through sagebrush about two feet high and directly past his mother. She bleated to him as he went by but he did not stop, going on into some dense *Atriplex* brush. On the other occasion a fawn was hidden in high meadow grass and apparently the doe had either lost the exact location of the fawn or it had moved. At any rate, when she bleated, it got up at least 100 feet away and came to her.

By the time fawns are 10 days old they can run with the mother but apparently are rather short-winded. Once they start following her, however, they do so much running and playing that by the time they are 15 to 20 days old, they can make long runs without showing much fatigue.

Bucks

Throughout most of the year the old bucks tend to remain by themselves, either singly or in small groups. Only during the rutting season are they to be found with the does in any numbers. Apparently some decadent individuals remain entirely alone throughout the year. The younger bucks generally mingle with the bands of does and fawns all the year around, although occasionally relatively large groups of young bucks may be found together.

Habits

The habit of racing first one way and then back is common in antelope, particularly when they are nervous or disturbed by something that they are unable to identify.

Many times when large bands are moving along undisturbed, I have seen individuals start from the rear of the band and race by the entire herd, whirl about, and dash all of the way to the rear, only to do the whole thing over again. Sometimes several will do this together.

Whether it is the desire for racing competition, exercise, release of pent up energy, or just because they are "antelope" and unpredictable, I do not know. Possibly it is to warm themselves, as I have generally noted it on cold days rather than warm ones.

This is not the only erratic habit of antelope, as I have witnessed many other unaccountable "stunts" on their part. One day Arthur Hensley and I were attempting to count a band of 975 head on the east side of Surprise Valley above Boyd Springs. They would not string out properly, but remained bunched in small groups, so it was impossible to get a count. They were "cornered" between us and deep snow that lay along the top of the ridge over which they would not pass. Finally Hensley started out to drive them past me, but they became interested and played hide and seek with him for several hours. Whenever he would get out of sight, they would hunt him up and then stand staring at him. Even by waving his arms and shouting, he was unable to frighten them. At last, they became tired, stopped in a solid mass in an opening in the junipers, and then walked and trotted past me in single file and were easily counted by both of us.

Another time when we were counting antelope, a small band of 26 was spotted about a half mile away across a valley. They were all watching us and just as we had finished counting them, they started running directly away from us. They ran up the slope of a hill, then put on a burst of speed and made a big curve back across the lower part of the valley and disappeared. In a few moments we heard a clatter of flying feet and here they came directly at us from behind and at about 100 yards distance. Suddenly they all swerved to the right, came around in a front facing us, and stopped. They stood thus with their rump hair on end for perhaps 20 seconds and then, with a snort from one or more, dashed off over a low ridge and back into the valley, stopped, and started feeding within a few yards of where we had first seen them.

On yet another occasion I spotted a large, lone buck lying dozing under a scraggy, dead juniper in Pete's Valley as I came down over a rim about 40 feet from him. He was facing the other way and did not see me. When I was about 25 feet distant, he apparently heard me as he quickly turned his head and saw me. He bounced straight up out of his bed about four or five feet in the air and landed with every hair standing on end, but did not run. He simply stood eyeing me intently. After what seemed at least a half a minute, he gave an extremely loud snort and ran with a bouncing gait for about 40 feet, then whirled about and stood facing me again only to snort and do it all over again. This continued until he was at least 200 yards away where he stood and watched me. I sat down on the side hill and watched him through the glasses. He finally moved under another juniper and pawed a bit and bedded down facing me. I then moved on but he only stood up until I turned away from him. The last I saw of him he was down again and chewing his cud, as I could see through the glasses. He certainly had very little fear of me. Like many nervous buck antelope, he urinated nearly every time he whirled to face me. This is most evident in late summer and fall.

I was very nearly run down by a large band of antelope near Horse Lake during the deer season of 1935. I had seen them off about a mile

away in an open basin, but had paid no attention to them. Shortly after, I heard five shots on a mountain above them and glanced that way to see if I could see any deer running in my direction. There were half a dozen deer coming down the slope out of the mahoganies toward the antelope. Suddenly, as the deer got within about 150 yards of them, the antelope started pell-mell out of the basin. They left the deer behind immediately and came on straight toward me traveling at a terrific rate. I did not sense any possibility of danger until they were 150 yards or less from me. Finally I realized they were pretty tightly bunched and those behind were crowding those in front, so I stood up thinking they would turn, but they did not. When they had approached to within about 100 feet, I started waving my arms and hat. It was very evident that those behind did not see me, but those in front split, some going to my right and some to the left. By the time the last of the band had split, some of them were less than 20 feet from me and were nearly lying over on their ribs as they swerved away to either side.

Antelope Gaits

Antelope appear to be stiff, awkward walkers, but they can walk rapidly. When walking, their movements are jerky; in fact, they appear to limp. Everything about them appears angular and uneven at this gait.

When trotting, their actions are smoother but the appearance of a limp is often still there. When loping, they move still more smoothly, but show some bobbing and occasionally bounce a little, particularly when starting or coming to a stop.

The running gait seems to be their most natural. There is little or no bouncing. It is much like the run of a horse, but smoother. When antelope are running at high speed their bodies lie low to the ground and their backs rise and fall very little. Their bounds when going full speed are not as long as those of deer. From right hind foot to right hind foot of several different sets of tracks that I measured, I found that the average was 14 feet. They are capable of broad jumps of at least 27 feet, as I measured two such jumps in Lassen County where they cleared an open, mud-bottomed cut.

When they are traveling at high speed, they do not tear up the ground as do deer. In fact, their tracks are surprisingly light for animals with so much drive in their hind quarters. Most of their power seems to be generated in the hind legs, while the front ones keep the body off the ground and on an even keel. Striking a hole does not seem to bother them particularly as I have seen them running at great speed across flats which were full of wide cracks. Investigation of the tracks showed they had stepped in some of them, but that no particular trouble was evidenced in negotiating the area.

They do not like soft mud and make every effort to keep on dry and solid ground. In fact, after the thaws begin in early spring, I have seen them well up in the lava cliffs and rim rocks where one might expect to see big horn sheep. At this season they stay off the flats entirely. Perhaps the lack of dew-claws hampers them in mud.

When running over rough lava and loose rocks they injure their feet quite often. Some limp after such a run and blood may be seen in their tracks. These injuries are apparently only superficial in most instances.

Speed

Many estimates have been made of the speed of antelope, but it is difficult to arrive at a true figure because there is no way of knowing when one is doing its absolute best.

Following are some of these estimates:

Heller	32 m.p.h. sustained speed.
Seton	32 m.p.h. for 1 mile estimate.
DeVore	43 m.p.h. (in Seton).
O'Connor	50 m.p.h., whole herds.
	60 m.p.h. and crossed in front.
	70 m.p.h., possibly for barren doe.
	50 m.p.h.; bucks, particularly old, are much slower.
	45 m.p.h., one old buck could do no better.
McLean	45 m.p.h. and young buck ran away from car.
	53 m.p.h. for 300 yards and holding even—two bucks. Sped up noticeably when shots were fired. Apparently capable of 53 for nearly one-half mile.
	42 m.p.h. for one-half mile and then sped up to cross in front of car and ran another one-half mile at about the same speed—four does.
	45 m.p.h., good buck on dry lake bed for 5 minutes then to 40 and gradually down to 35, and then dodged off as evidently tired.
	35 to 40 m.p.h. at a rather long distance but will tire rather quickly if forced above this, as a conclusion.

The following details of my observations listed above are, I feel, fairly accurate.

Between Grasshopper Valley and Dry Valley in Lassen County, A. L. Brown and I saw two large buck antelope start racing the car as is often their habit. They were about 150 feet to our right and even with the car when they paralleled us, and as I sped up, they did likewise. The speedometer showed 53 miles per hour for about 300 yards and the antelope were still even, but closer to the car. Brown shot two revolver shots in the air, at which the antelope went still faster and pulled away. I was not able to drive faster because of the road surface. They finally stopped and turned around facing the road after running about one mile. The excessive burst of speed, following the shots, probably did not last more than 250 yards, but it was certainly evident that they were capable of at least 53 miles per hour for nearly a half mile.

On the Madeline Plains east of Ravendale, four antelope does ran along beside the car for about one-half mile at 42 miles an hour, suddenly put on a burst of speed and crossed directly in front, then raced along just ahead of the car for another one-half mile at about the same speed when they crossed over in front again and stopped about 100 yards from the road. These animals were certainly not particularly frightened. In fact, I think it was curiosity and the joy of a race that prompted them to stay by the car for such a distance.

On a flat, dry lake bed in northwestern Nevada, I chased one good buck that hit 45 miles an hour for about five minutes, then dropped to 40 and then to 35. I kept to the outside of the animal most of the time to keep him on the open lake bed. He evidently got tired, as all of a sudden he decided that he had had enough and dashed across in front of the car and went up a slope above the lake bed and on over the top of a ridge to the west. It is my opinion that an antelope can

run between 35 and 40 miles per hour for a long distance, but will tire quickly at anything over that.

I have noted that shortly after gathering speed, most all of the antelope in a band open their mouths regardless of the temperature. This may be due, at least in part, to their small lung capacity. After a short sprint, they can be heard breathing heavily as they pass by, even above the clatter of their feet. In contrast to its relatively small lungs, the antelope has a large and extremely muscular heart for an animal of its size.

The hoofs are large compared with those of deer; in fact, a large buck antelope has bigger feet than a buck mule deer of more than twice his weight.

Vision

Of all mammals with which I am familiar, the antelope has by far the keenest vision, with the possible exception of the big horn sheep. Their noses are good and so is their hearing, but they depend primarily on eyesight to detect approaching danger. I have yet to show myself in full view of a band of antelope anywhere within a mile and a half without having some of the band spot me before I walked more than a few feet. They seem to see about as well as I can through 16 power binoculars—possibly better.

I am convinced also that they know their home terrain so well that anything unusual, however small, that appears in their field of vision is quickly spotted. One such instance occurred on Eagle Head Plateau south of Rush Creek in Lassen County. I slipped up to a rim rock and showed just the top half of my head over the edge. Below me and nearly 500 yards away was a band of about 90 antelope. Upon looking through the glasses, I saw at least 10 antelope gazing at me. They had picked up the movement of my head as it was pushed above the rim even at that distance. The wind was blowing toward me, so they had not gotten my scent first to put them on the alert. After I had remained there quietly for some time, some of them came toward me about 200 yards to investigate further.

I saw another band of about 200 in Upper Smoke Creek watching a coyote that was at least three-quarters of a mile away on a rocky slope.

Many times antelope will continue feeding and let on they do not see you or do not care. One large, close band continued feeding even when I was walking toward them across open ground. However, I could tell they were watching me even when their heads were down by the way they turned their heads and the fact that they gradually moved away. All of a sudden they all trotted off about 200 yards, then swept around in an arc, raced by me within about 50 yards and went over a hill only to reappear about 400 yards to the north and come back by me again at about the same distance as before. They all stopped on a little ridge and turned facing me, some of them snorting and running this way and that, but not going away from the rest of the herd.

Horns

Antelope have horns, not antlers as do deer. The horns are plainly made up of modified hair and can be separated out into individual hairs,

particularly near the base. The fully grown horn is dark blackish-brown, some having ivory white tips for an inch or less. The outside sheath or covering is shed each year, leaving the core of the horn which is part of the skull. The new horn starts growing on the tip and sides of this core and gradually pushes the old horn up and off. Many of the record and near record sets of horns are a combination of new and old horns. The horns, even when fully grown and hardened, are not very securely attached to the core, as movement can be noted if the horn is twisted from side to side.



FIG. 89. Head and neck of adult buck antelope (left) and doe (right), showing horns and normal markings.

The horn normally has an upwardly directed main shaft with the one prong projecting forward and braced with a heavy web against the main shaft. The prong plays a definite part in the protection of the buck from injury to the face and head when fighting. The opponent's horn or prong is caught on the hook of the prong and this keeps him from gouging with his horn tips. The curved-in, sharp-ended points on the horns are excellent gougers and when brought in contact with the side of the head or neck are hooked in and ripped, making the hair fly and probably cutting into the skin and flesh on occasion. While looking over a number of antelope capes, I noted many had scars showing on the inside of the skin on the cheeks and neck that looked as if they had been made in this way.

Freak horns of various shapes are not uncommon among antelope. Some are wide-spread, some straight up and parallel, some tipped forward, some with double prongs; in fact, most any type you could imagine. There was one four-horned buck that we saw for a number of years near the Horn Ranch at the southeastern end of the Madeline Plains. He had one normal set of horns and another set of about equal size growing between the first set. Several were killed during the 1942 and 1943 seasons with cock's-comb shaped horns on the bridges of their noses. This was attached to the skin over the base of the nasal bones.

The time of shedding the outside horn sheath seems to vary considerably. I have seen large, old bucks that had shed by October 10, and I have seen smaller bucks that still had their horns on December 1. It appears that larger bucks in good condition shed first. Shed horns disintegrate very rapidly and are nearly all gone by the following year. This is probably due to their structure which allows water to soak in between the fibrous parts. Freezing then forces the horn apart into a ragged mass which soon disintegrates, its remnants resembling pieces of dried rootlets. The hard tips sometimes last for several years.

Does' horns are small and barely show an indication of the prong in some instances. I have not seen a doe's horns over three and a half inches long, although I have heard of two a little over four inches and one about seven inches.

Male fawns at birth have a small bump over each eye. The horns break through the skin in the fall and are loosely attached to the skin. They ordinarily grow to about an inch in length by January, when they are shed. The following fall they are shed a little later than those of the older bucks, and when two and a half years old, they are dropped at the same time as the others.

Census Methods

Formerly antelope were estimated or counted by crews of picked men working from horseback or on foot. About six or seven men generally made up a crew, working in twos or threes in most areas. Occasionally, however, all joined to form one crew in places where large numbers of antelope in a limited area had to be counted at one time to avoid the possible duplication that might occur if they were not all counted in one day. Because of soft ground and rocky terrain, most of the counting had to be done on foot. In order to count the two counties, Modoc and Lassen, properly, each man of a six-man crew had to walk or ride about 600 miles—about 26 days of effort per man.

The extensive use of the airplane was started in the late winter of 1941-42. This first airplane census was carried on under the Federal Aid in Wildlife Restoration Act as part of Project California 12-R, "Aerial Survey of Big Game in Northeastern California and in Owens Valley." James D. Stokes of the Division of Fish and Game was the observer and A. L. Reese the pilot during the 1941-42 survey. The 1943 and 1944 censuses were made with regular Division of Fish and Game funds, with D. D. McLean as observer and John Allen as pilot. This method is far superior to the old from the standpoint of speed, accuracy, and expense.

The system normally used in counting is to cover the area in strips of one-half mile or less in width. During the winter season when the counts are made, the sun is low and in the south, so the counters work back and forth from east to west and vice versa, beginning at the south side of the area to be counted and working north so the sun is always at the counters' backs. The normal altitude of flight for best results is from 400 to 800 feet.

When a herd is sighted, it is counted as soon as possible by the observer, or observers, and the pilot independently. Small bands can be counted quickly, whereas larger herds must be circled, crowded together, flown over at low altitude to start them off in a string, and then passed from the rear and counted while passing. This sounds difficult, but one group of 1,155 was counted by three of us in this manner, independently, with less than 3 per cent difference. The average of the independent counts is used as the final figure unless there is more than 5 per cent difference, in which case they are recounted. No effort is made to separate sexes, as the counters do not have time. Counts on large herds are made from greater distances than those made on small bands. Often we move off to the side about 1,000 feet for counts of the larger groups. Photographic counts were tried but found to be of little value as one missed picture would upset the whole count.

As against the foot and horseback method, which often missed antelope that happened to be on the other side of a knoll, the airplane is flown high enough to see over such obstructions giving the observers an open, uninterrupted view of all the terrain.

Bad flying weather is the only real problem during the winter range counts. Extended stormy periods sometimes make the counting difficult. Because of this, it is necessary to count a complete block of winter range at one time so as not to count the same antelope a second time at a later date. It is also difficult to count antelope against a background of snow, particularly when bare ground alternates with patches of snow.

There are a few short-comings in the use of the airplane. If a large, radial motor is used, making a high obstruction in front of the observer, an occasional herd of antelope is passed over directly under the plane. Best results are secured with a plane that cruises under 125 miles per hour, but it is necessary to have sufficient power to get out of bad situations that regularly arise due to air currents and rough terrain. The type of flying required is extremely dangerous because of the low levels flown. If anything went wrong there would be little chance of gliding to anything but a crash landing. It is, therefore, extremely important to have a pilot of long experience and with the ability to land a plane on a side hill or lava bed and still be able to walk away from the crack-up. This requires a complete mastery of the plane so as to be able to "stall" it in at the slowest possible speed.

It requires about 35 hours of flying to properly cover the winter range area at 120 miles per hour. Even at the present high rate of airplane rental, this is much less expensive than the old horseback and foot method.

The counts for the three years, 1942-44, are shown in Table 1. The progressive growth in the yearly totals is perhaps due in part to the growing efficiency in the methods of carrying out the census, which

has reduced the number of animals missed when making the count. However, there is no doubt that it reflects in part the fact that, regardless of the open hunting seasons of 1942 and 1943 (to be discussed in the next section), the antelope are increasing in number. The species being polygamous, enough bucks are left by the hunters to carry on the breeding; the fawn crop bears this out.

TABLE 1
Details of Three Years of Antelope Count
Modoc County

	1942	1943	1944
XL Ranch.....	224	124	82
Likely Tables.....	420	364	389
Clear Lake.....		71	
Surprise Valley.....		152	376
Rattlesnake Creek.....		377	256
Cloverswale Creek.....			64
West of Adin.....		10	
East of Adin.....	12	5	
Modoc County totals.....	656	1,103	1,167

Lassen County

	1942	1943	1944
Spencer Creek.....	271	530	
Skeedaddle Creek.....	255	1,214	874
Bull Flat.....	158		
Shaffer Mountain.....	317	610	545
Mud Flat.....	242	100	1,904
Little Mud Flat.....	300	66	
Brubeek Spring.....	27		
Rush Mountain.....	389		
Rush Creek.....	87		
Three and Five Springs.....	437	208	140
Rice Canyon.....	103	201	52
Smoke Creek.....		374	435
Snowstorm Mountain.....		143	530
Pete's Valley.....		159	
Willow Creek Valley.....		26	8
Big Valley.....	15	33	
Dixie Valley.....	60	67	16
South of Constantia.....		14	
Tule Mountain.....		46	
South Slope Hot Springs Mountain.....		171	
Hog Springs.....	398		
Lassen County totals.....	3,050	3,962	4,504

Siskiyou County

	1942	1943	1944
Mount Dome.....	*37	273	305
Grand totals.....	3,752	5,338	6,147

* Observer was certain that two large herds were missed.

NOTES :

In Shasta County, near Fall River Mills, 171 head were found in 1944.

The counts in 1942 and 1943 were made during January, February, and March. The count in 1944, under better weather conditions, was made from February 2d to February 15th.

Open Seasons

From the information gathered during these surveys it has been possible to endorse the limited open season authorized by the Legislature. Claim was made that antelope were beginning to damage crops. Two seasons have now passed with a maximum allowable kill of 500 buck antelope with horns longer than the ears. Five hundred licenses have been issued annually under a lottery system in which application is made and a number given to each application. These numbers are drawn until 500 has been reached, then 500 alternates are drawn in



FIG. 90

case some of the original applicants are not able to secure the five dollar license or are unable to hunt.

During the 1942 season, 452 hunters took 405 antelope. During the 1943 season, 452 hunters took 362 antelope. In 1942 there were 47 hunters who were unlucky and in 1943 there were 90. During both years there were 48 prospective hunters who found they were unable to go at the last minute because of sickness, gas shortage, tires, etc.

Strategically located checking stations were set up each season where the hunters were checked in on arrival and out at the completion of the hunt. Here the antelope were weighed, measured, and checked as to condition of the animal, pelage, diseases, and parasites. Each animal checked had a separate sheet and the data thus secured are summarized below.

TABLE 2
Comparison of Live and Dressed Weight of Antelope

Live	Hog dressed	Loss	Per cent loss	Time killed
Lbs.	Lbs.	Lbs.		
140.....	112	28	20	2:00 P.M.
130.....	100	30	23	7:00 P.M.
125.....	100	25	20	10:30 A.M.
123.....	102	21	17	10:00 A.M.
120.....	88	32	28.6	4:30 P.M.
120.....	96	24	20	6:30 P.M.
117.....	98	19	16.2	2:00 P.M.
114.....	93	21	18.4	9:00 A.M.
112.....	98	14	12.5	12:00 P.M.
110.....	95	15	16.6	5:00 P.M.
100.....	86	14	14	5:00 P.M.
95.....	75	20	21	8:45 A.M.
94.....	80	14	14.8	10:00 A.M.
90.....	78	12	13.3	9:00 A.M.
Average loss.....				18.17%
Average actual dressed weight of 308, 1942 season.....				82.1 lbs.
Average actual live weight of 26, 1942 season.....				114.7 lbs.
Average actual dressed weight of 244, 1943 season.....				92.2 lbs.
Average actual live weight of 41, 1943 season.....				111.6 lbs.

TABLE 3
Average Measurements of Various Anatomical Features

Average total length of 275.....	57.46 inches
Average tail length of 251.....	4.40 inches
Average length of hind foot of 251.....	17.67 inches
Average length of ear of 359.....	6.42 inches
Average spread of horns of 377.....	11.45 inches
Average right horn base circumference of 345.....	6.34 inches
Average left horn base circumference of 345.....	6.28 inches
Average right horn length outside curve of 384.....	11.64 inches
Average left horn length outside curve of 384.....	12.56 inches

TABLE 4
Ten Best Heads by Length of Beam
1942

Length		Prong		Spread	Tip to tip	Base	
Right	Left	Right	Left			Right	Left
17	16 $\frac{1}{4}$	4 $\frac{1}{4}$	4 $\frac{1}{4}$	15 $\frac{1}{2}$	12 $\frac{1}{2}$	7 $\frac{3}{4}$	7 $\frac{3}{4}$
16 $\frac{5}{8}$	16	5 $\frac{5}{8}$	5 $\frac{5}{8}$	11 $\frac{1}{4}$	6 $\frac{1}{2}$	8 $\frac{1}{4}$	7 $\frac{5}{8}$
16 $\frac{3}{4}$	16 $\frac{1}{4}$	3	3	13	7	7	7
16 $\frac{1}{4}$	16	4	3 $\frac{3}{4}$	12 $\frac{1}{4}$	4 $\frac{1}{2}$	7 $\frac{1}{2}$	7 $\frac{1}{4}$
16 $\frac{1}{2}$	16 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	10 $\frac{1}{2}$	6	7 $\frac{3}{4}$	7 $\frac{3}{4}$
16 $\frac{1}{2}$	16 $\frac{1}{2}$	5 $\frac{1}{8}$	5 $\frac{1}{8}$	10 $\frac{1}{2}$	1 $\frac{1}{4}$	7 $\frac{3}{4}$	7 $\frac{1}{2}$
16 $\frac{1}{2}$	16 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	11	8 $\frac{3}{8}$		
16 $\frac{3}{4}$	16 $\frac{1}{2}$	4	4 $\frac{3}{8}$	15	9	8 $\frac{3}{8}$	8 $\frac{3}{8}$
16 $\frac{1}{2}$	16 $\frac{3}{8}$	4 $\frac{3}{4}$	4 $\frac{1}{2}$	13 $\frac{3}{8}$	6 $\frac{3}{8}$	7 $\frac{1}{2}$	7 $\frac{3}{8}$
16 $\frac{1}{4}$	16 $\frac{1}{4}$	4	4	11	3	7 $\frac{1}{8}$	7 $\frac{1}{8}$

1943

Length		Prong		Spread	Tip to tip	Base	
Right	Left	Right	Left			Right	Left
16 $\frac{7}{8}$	16 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{5}{8}$	14 $\frac{1}{8}$	9 $\frac{1}{8}$	6 $\frac{1}{2}$	6 $\frac{3}{8}$
16 $\frac{3}{4}$	16	5 $\frac{1}{2}$	5	20 $\frac{3}{4}$	16 $\frac{1}{4}$	6 $\frac{3}{4}$	6 $\frac{3}{4}$
16 $\frac{3}{4}$	15 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	10 $\frac{5}{8}$	3 $\frac{1}{2}$	6 $\frac{3}{8}$	6 $\frac{3}{8}$
15 $\frac{1}{4}$	16 $\frac{3}{8}$	3 $\frac{3}{4}$	3 $\frac{3}{8}$	12 $\frac{3}{4}$	3 $\frac{3}{8}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$
16	16	5 $\frac{1}{8}$	5 $\frac{1}{4}$	17	12 $\frac{3}{8}$	7 $\frac{5}{8}$	7 $\frac{3}{4}$
16	16	5	5	15	6 $\frac{1}{2}$	8 $\frac{1}{2}$	8 $\frac{1}{2}$
16	16	4 $\frac{1}{4}$	4 $\frac{1}{4}$	9	1 $\frac{1}{2}$	8	8
16	14	4 $\frac{1}{4}$	4 $\frac{1}{4}$	8 $\frac{3}{8}$	1 $\frac{1}{4}$	7	7
12 $\frac{1}{8}$	16	3 $\frac{1}{2}$	3 $\frac{1}{2}$	22 $\frac{1}{2}$	20 $\frac{1}{2}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$
15 $\frac{3}{4}$	15 $\frac{3}{4}$	3 $\frac{3}{4}$	2 $\frac{1}{8}$	15 $\frac{3}{4}$	5 $\frac{1}{4}$	7	6 $\frac{3}{4}$

TABLE 5
Ten Best Heads by Extreme Spread
1942

Spread	Length		Prong		Tip to tip	Base	
	Right	Left	Right	Left		Right	Left
19 $\frac{1}{8}$	14 $\frac{1}{2}$	15	2 $\frac{3}{8}$	2 $\frac{3}{8}$	18	6 $\frac{1}{2}$	6 $\frac{1}{2}$
19	15 $\frac{1}{8}$	15 $\frac{1}{8}$	4 $\frac{1}{8}$	4 $\frac{1}{8}$	15 $\frac{1}{4}$	7	7
18 $\frac{1}{2}$	13 $\frac{1}{4}$	13 $\frac{1}{2}$	3 $\frac{1}{8}$	2 $\frac{1}{2}$	16	7 $\frac{1}{8}$	7 $\frac{1}{8}$
18	15 $\frac{3}{8}$	15	3 $\frac{1}{4}$	4	13 $\frac{3}{4}$	7 $\frac{1}{8}$	7 $\frac{1}{8}$
17 $\frac{1}{8}$	14 $\frac{1}{8}$	14 $\frac{1}{8}$	5 $\frac{5}{8}$	5 $\frac{1}{8}$	8 $\frac{5}{8}$	6 $\frac{5}{8}$	6 $\frac{5}{8}$
16 $\frac{7}{8}$	14 $\frac{7}{8}$	15 $\frac{1}{2}$	3 $\frac{1}{8}$	4	11 $\frac{1}{2}$	6 $\frac{7}{8}$	6 $\frac{7}{8}$
16 $\frac{1}{2}$	14	14 $\frac{3}{4}$	3 $\frac{1}{4}$	3	9 $\frac{1}{2}$	6	6
16 $\frac{1}{4}$	14 $\frac{7}{8}$	14 $\frac{1}{4}$	3	3		7 $\frac{1}{4}$	7 $\frac{1}{4}$
16	12 $\frac{1}{4}$	12 $\frac{3}{4}$	3	3	12 $\frac{3}{8}$	5 $\frac{1}{4}$	5 $\frac{1}{4}$
15 $\frac{3}{4}$	13	13	6	6	10 $\frac{3}{4}$	7	7

1943

Spread	Length		Prong		Tip to tip	Base	
	Right	Left	Right	Left		Right	Left
22 $\frac{1}{2}$	12 $\frac{1}{8}$	16	3 $\frac{1}{2}$	3 $\frac{1}{2}$	20 $\frac{1}{2}$	5 $\frac{3}{4}$	7
20 $\frac{3}{4}$	16 $\frac{3}{8}$	16	5 $\frac{1}{2}$	5	16 $\frac{3}{4}$	6 $\frac{3}{4}$	6 $\frac{3}{4}$
19 $\frac{1}{4}$	11 $\frac{1}{2}$	13	3	2 $\frac{1}{2}$	16 $\frac{7}{8}$	6	6
19 $\frac{1}{4}$	13	13	2	2	19 $\frac{1}{4}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$
19	14 $\frac{1}{2}$	14 $\frac{1}{2}$	4 $\frac{3}{4}$	4 $\frac{3}{4}$	6 $\frac{3}{4}$	5 $\frac{3}{4}$	5 $\frac{3}{4}$
17 $\frac{1}{2}$	14 $\frac{3}{4}$	14 $\frac{3}{8}$	3 $\frac{1}{2}$	3 $\frac{1}{8}$	11 $\frac{3}{8}$	5 $\frac{3}{4}$	5 $\frac{1}{2}$
17	16	16	5 $\frac{1}{8}$	5 $\frac{1}{4}$	12 $\frac{5}{8}$	7 $\frac{5}{8}$	7 $\frac{3}{4}$
17	15 $\frac{1}{2}$	15 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	12	7	7
17	15 $\frac{1}{4}$	15 $\frac{1}{4}$	2 $\frac{3}{4}$	2 $\frac{1}{4}$	14	6 $\frac{1}{2}$	6 $\frac{1}{2}$
16 $\frac{3}{4}$	14 $\frac{1}{2}$	14 $\frac{3}{4}$	2 $\frac{3}{4}$	2 $\frac{3}{8}$	8 $\frac{5}{8}$	6	6

Literature Cited

Caton, John Dean

1877. The Antelope and Deer of America. Second Ed., pp. 17-65.

Heller, Edmund

1930. The American Prong-horned Antelope. Bull. Wash. Park Zoo. Soc. Vol. 1, No. 4, May-June.

Miller, Gerrit, S., Jr.

1924. List of Recent North American Mammals. U. S. Nat. Mus. Bull. 128, pp. 493-494.

O'Connor, Jack

1939. Game in the Desert. Pp. 107-126.

Seton, Ernest Thompson

1929. Lives of North American Mammals. Vol. III, pt. II, pp. 413-467.

THE FUR CATCH IN CALIFORNIA 1940-1941¹

By HOWARD TWINING

*Bureau of Game Conservation,
California Division of Fish and Game*

For the past 23 years the California Division of Fish and Game has received catch reports from licensed fur trappers. Each year these reports have been summarized and used by the Division as an aid in understanding fluctuations in the fur supply. They have been helpful in indicating the importance of commercial trapping, but always there has been doubt regarding the *total* number of trappers actually at work each year and the *total* fur take in the state.

There are several reasons why the reports of licensed trappers do not represent the total catch in the state: (a) Trappers for predatory animals need not buy a license and are not required to submit a report of catch; (b) those under 18 years of age need not buy a license nor report; (c) some trap illegally without a license, and (d) some licensed trappers fail to report. These trappers' reports, however, have been the only records readily available for consultation and much of the fur policy of the Division has been based on information taken from them.

In 1940, most of the 28 fur buyers in California were asked the question, "How many persons do you believe trap fur in this state

TABLE 1
The Fur Catch in California, 1940-1941

Species	From trappers' records		From buyers' records		Estimated total number of animals sold by all trappers	Estimated total price
	Number of animals	Value	Number bought by reporting dealers	Number bought by non-reporting dealers (computed)		
Opossum.....	1,485	\$312 46	2,173	711	2,884	\$591 97
Raccoon.....	7,265	9,672 45	9,464	5,457	14,921	19,241 64
Ring-tailed Cat.....	1,491	2,275 92	1,171	955	2,126	3,189 42
Marten.....	402	6,207 81	84	346	430	6,604 26
Fisher.....	5	183 50	3	2	5	269 24
Weasel.....	171	58 71	91	119	210	67 03
Mink.....	1,710	8,339 77	1,333	687	2,020	10,234 09
River Otter.....	26	173 37	9	21	30	189 00
Civet Cat.....	1,368	224 48	1,117	781	1,898	292 85
Striped Skunk.....	14,535	13,189 90	18,785	6,233	25,018	22,386 72
Badger.....	156	106 51	125	153	278	199 96
Grey Fox.....	5,047	5,619 47	4,423	2,519	6,942	7,471 08
Kit Fox.....	217	116 19	1,450	413	1,863	1,003 13
Red Fox.....	12	85 72	2	12	14	100 28
Coyote.....	3,285	7,113 93	2,613	2,125	4,738	10,229 35
Wildcat.....	2,776	4,665 69	2,297	1,941	4,238	6,698 59
House Cat.....	451	44 15	184	47	231	23 85
Muskrat.....	51,426	66,426 23	7,580	60,590	68,170	94,079 76
Sandrat.....	16,892	6,254 64	7,869	9,324	17,193	6,144 37
Totals.....	108,720	\$131,070 90	60,773	92,436	153,209	\$188,956 58

¹ Submitted for publication, April, 1944.

each year?" The estimates varied from 3,000 to 10,000. It was at this time that the Fur Project² of the California Division of Fish and Game conceived the idea of analyzing records of purchases by fur buyers so that by comparing these with the reports of licensed trappers an estimate of the total number of trappers and the total fur take could be prepared.

Twenty-three buyers cooperated by submitting their records of purchases for the 1940-1941 season. The records were transferred to punched cards and tabulated by the staff of the Bureau of Marine Fisheries. The statistical methods used in developing the final estimates of the fur catch are rather complex and are described at the end of this article.

In the year from July 1940 to June 1941, predatory animal trappers employed by the U. S. Fish and Wildlife Service and the State Department of Agriculture, in cooperation with various counties, caught 5,792 coyotes and 1,155 wildcats. Trappers hired by the Division of Fish and Game caught 3,178 coyotes and 1,009 wildcats. Only a small number of these were caught in the winter season and sold, but they would increase the total number of animals caught as follows:

Coyote:	4,738	estimated catch by commercial trappers
	5,792	catch by Federal, State, and County trappers
	3,178	catch by Fish and Game trappers

13,708 total catch of coyotes

Wildcat:	4,238	estimated catch by commercial trappers
	1,155	catch by Federal, State, and County trappers
	1,009	catch by Fish and Game trappers

6,402 total catch of wildcats

Totals:	153,209	estimated catch by commercial trappers
	11,134	catch by predatory animal trappers

164,343 total caught by all trappers

In addition to the above mentioned trappers, there are predatory animal trappers hired with funds provided by certain counties and by stockmen. These records we have not been able to obtain. Their catch, in addition to the coyotes and wildcats occasionally killed by ranchers and hunters, we estimate would raise the total catch of coyotes to more than 16,000.

It would be easy to determine the total amount of fur sold in California if all trappers were licensed and required to report. It would be even easier if all fur were sold within the boundaries of the state. The problem is complicated by the fact that all trappers do not report their catch to the Division and also by the fact that it would be next to impossible to get records from the hundreds of fur buyers all over the United States of their purchases from California trappers. It was necessary to develop a method of making estimates of these missing records.

In the season of 1940-1941 California trapping licenses were taken out by 1,833 persons. Of these only 1,380 reported that they actually trapped and caught fur. Buyers in California reported that they bought

² Federal Aid in Wildlife Restoration, Project California 5-R, A Survey of the Fur Resources of the State of California.

fur from 895 licensed California trappers, indicating that the remainder of the 1,380 reporting licensees sold to buyers outside the State. Further, California buyers reported buying from 1,726 unlicensed trappers in California. To proceed with the estimate, it is now necessary to make the basic assumption that the same proportion of unlicensed as of licensed trappers sold fur out of State. This opinion is based on information from several sources, but mainly upon impressions gained from interviews with unlicensed trappers. Both out of State and California buyers use the lists of names of licensed trappers in the files of the Division of Fish and Game. It might be expected that boys would be more liable to sell to local buyers, but in checking the reports of 41 members of the Junior Game Patrol who specified where their furs were sold, it was found that more sold out of State than in the State (26 out of State, 15 in the State).

Returning now to our reported figures, and applying to them the proportion of our basic assumption, we have:

<u>Total of licensed trappers</u>		<u>Total of unlicensed trappers</u>	
Number of licensed trappers selling fur in California	=	Number of unlicensed trappers selling fur in California	

Letting x stand for the total of unlicensed trappers, and substituting the reported figures for the other factors in the proportion, we have:

$$\frac{1,380}{895} = \frac{x}{1,726}, \quad x = \frac{1,380 \times 1,726}{895}$$

or x , the total number of unlicensed trappers in California is estimated at 2,661. Adding this to the 1,380 licensed trappers, the total number of trappers in the State in the 1940-1941 season would be 4,041. Prices were comparatively low this year and few trappers were at work as compared with, for instance, the season of 1928-1929, when 6,482 were licensed to trap.

At first glance it seems strange that although there were nearly twice as many unlicensed as licensed trappers they caught only 44,489 pelts as compared with 108,270 caught by licensed trappers. The average income of the licensed trappers was \$97.15, while that of the unlicensed trapper was only \$20.58. We believe that these proportions are very nearly correct. Unlicensed trappers are largely minors who take only a few furs each season. Fur buyers tell us that the enthusiasm of most youngsters is short-lived and their average catch is very low. The ranks of unlicensed trappers must include a great many men who shoot or trap a predatory animal or two and rather than waste the fur send it in to a buyer. Licensed trappers are often professional trappers who take large amounts of fur. Muskrat trappers especially account for a large percentage of this catch.

Licensed trappers are required to report to the Division the animals caught, prices paid for each kind, and the buyer to whom sold. From these reports we can then determine the proportion of fur sold in the State and the proportion sold out of State. This proportion varied for each species. For example, trappers reported selling most of their marten to out-of-State dealers and most of their coons to California

dealers (see accompanying table), so it was necessary to calculate each species separately. The proportion of fur sold out of State was applied to the buyers' reports. That is, the total amount of fur of each species bought by California buyers was increased by the proportion that licensed trappers reported selling out of State and the total number of each species sold out of State was thus obtained. These calculated figures are shown in the table.

A complication was encountered when one of the most important buyers in the State refused to cooperate in the project. The records of several minor buyers also were not obtained. Estimates of their purchases were made by considering them on the same basis as out-of-State buyers.

The problem was further complicated by the discovery that the total amount of fur reported sold to dealers by licensed trappers was 9 per cent more than the dealers reported buying from the trappers. This may have been because some dealers failed to report part of their purchases, or it could have been because trappers are inclined to exaggerate the amount of fur they trapped. To be on the conservative side, we assumed that the dealers' reports were accurate.

For the use of those who are interested in duplicating the procedure followed in this project, one animal (the raccoon) will be taken here as an example and the process applied to it will be explained.

A represents the number of pelts reported by trappers as having been delivered to reporting dealers. Coon = 2,823.

B represents the number of pelts reported by trappers as having been delivered to nonreporting dealers. Coon = 2,519.

C represents the number of pelts reported by 23 dealers as having been purchased from licensed trappers. Coon = 3,155.

D represents the number of pelts reported by 23 dealers as having been purchased from unlicensed trappers. Coon = 2,963.

$E = \frac{B}{A} \times C$, the weighted number of pelts for the non-reporting dealers purchased from licensed trappers. (This corrects the 9 per cent discrepancy.) Coon = 2,814.260.

$F = \frac{B}{A} \times D$, the weighted number of pelts for the non-reporting dealers purchased from unlicensed trappers. Coon = 2,642.996.

$G = E$ plus F , the total number of pelts purchased by the nonreporting dealers. Coon = 5,457.

H = the total number of pelts purchased by reporting dealers. Coon = 9,464.

G plus H = the total number of pelts sold. Coon = 14,921.

The analyzing of dealers' records was first contemplated as an annual project. The great amount of labor involved precluded the

undertaking of the job in 1942, but it is hoped that it can be done at least once again in a year when fur prices are high and more trappers are at work. In the meantime, we believe that the proportionate increase of the total catch over the reported catch in the 1940-1941 season can be applied to the reported catch of any year to give a rough estimate of the total take for that year.

Summary

A. A tabulation of the approximate total number of each species of fur animal taken by trappers in the season 1940-1941 has been made possible by the mechanical analysis of trappers' and fur buyers' records.

B. The catch was small, as fewer trappers than usual were at work because of low fur prices.

C. Calculations showed that approximately 153,209 furs were sold for a total price of \$188,956.58.

D. There were approximately twice as many unlicensed as licensed trappers, but the number of furs caught by unlicensed trappers was less than one-third of the total catch.

E. Muskrats led the list with 85,363 furs sold, striped skunk followed with 25,018, grey fox was third with 6,942, and coyote fourth with 4,738.

F. Muskrats brought trappers the most money with a total value of \$100,224.12; striped skunk brought \$22,386.72; raccoon brought \$19,241.64, and mink \$10,234.09.

G. The number of coyotes caught and sold was 4,738; the number of wildcats 4,238. When the catch by government trappers is added, the total number of coyotes caught is increased to 13,708; the catch of wildcats to 6,402.

H. The computed total of trappers who sold fur in the season of 1940-1941 was 4,041.

I. It is believed that rough estimates of the total fur take for future seasons may be made by increasing the totals reported by licensed trappers to the Division of Fish and Game in the same proportions as shown in the above table.

EDITORIALS AND NOTES

TWENTY-FIVE YEARS AGO IN CALIFORNIA FISH AND GAME

In CALIFORNIA FISH AND GAME twenty-five years ago Carl Westfeld, the executive officer, gave, in the course of an article dealing largely with other matters, the following brief description of this periodical:

CALIFORNIA FISH AND GAME, a quarterly magazine devoted to the conservation of fish and game in California, contains

1. Numerous articles on game species, means of identifying them, their past and present status, and the means whereby they may be conserved.
2. Statistics bearing on the abundance of game species.
3. Reports of work accomplished by commission; activities initiated.
4. Financial reports.

That description would seem to fit rather closely still. And yet, comparing the issues of twenty-five years ago with recent ones, it becomes apparent that the emphasis has changed. To clarify this point, an excerpt from an editorial in the number following the one quoted above may be permissible:

CALIFORNIA FISH AND GAME was started as a means of moulding public opinion, for it was believed that: "The effectiveness of game protection is governed by the interest of the people and the spirit of those who hunt and fish." The magazine has acted primarily in an educational and publicity capacity, but it also constitutes a record of activities and accomplishments which are of historical value.

That the magazine acts in an educational capacity is, we hope and believe, still true; but its publicity function can no longer be considered a primary one. For proof of this the mailing list alone suffices, for it contains less than 4,000 names. To be sure, the number of readers is greater, for it goes to many libraries, schools, colleges, and other organizations; but at best, the publicity value of a journal with so restricted a circulation can not be considered high.

Twenty-five years ago the number of copies printed was 5,200. That was not much greater than at present, but sights were already set on a far higher target. The circulation increased from year to year until the peak was reached in 1931 with a printing of 11,000 copies. One year later the number had dropped to 3,000. The reason for this phenomenal decline was simple: a suspicion was born that many of those receiving the magazine took it principally because it came gratis; to test this, a charge was made; and the number of those interested enough to pay was only a fraction of the original total. Having winnowed out what might be called the deadheads by the application of hard economic law, the effort was made, when the magazine was once more issued free, to restrict its mailing list to those genuinely interested and legitimately entitled to receive it; and this has been the aim ever since.

Publicity *per se* having in the course of this evolution ceased to be a mainspring, material of current and popular appeal such as might be expected to swell the mailing list gradually disappeared from the magazine. Material of this sort, much of which was printed in the earlier quarterlies under such headings as "Hatchery Notes," "Life History Notes," etc., still goes out from the Fish and Game Commission in the form of news releases to the press, through which it reaches a far greater number of readers than it could in any other way. CALIFORNIA FISH AND GAME has become principally a medium for the recording of the work accomplished by the Division of Fish and Game, and of the operations and investigations of others which affect the fish and game of the state. It is a sober record, at present, perhaps to some of its readers too sober, but it is difficult to be entertaining when presenting the results of original research—results which, to a greater or less extent, are true additions to the sum total of human knowledge. It is realized that accounts of scientific work written in a style to be interesting and informative to the non-scientist have a definite place in the magazine. It is also realized that reports of the work of the Division are at present not as complete as they should be. When the war ends, and our many absent workers return, expansion in both these directions can be looked forward to. "Conservation of wildlife through education" still stands on our cover; but where the educational effort was in earlier years to broadcast a great variety of information to a great variety of people, it is now to make available specialized information to people of specialized interests.—*Brian Curtis, Editor, California Fish and Game.*

IN MEMORIAM

E. CLARENCE MOORE

The Fish and Game Commission, meeting in Los Angeles July 14-15, 1944, unanimously passed the following resolution commemorating the death of Dr. E. Clarence Moore at Los Angeles July 10th. Dr. Moore was president of the Fish and Game Commission from February, 1935, to January, 1939.

WHEREAS, Dr. E. Clarence Moore who served the people of the State of California for five years as a member of the Fish and Game Commission has been called by death ; and

WHEREAS, He is remembered with great affection by all who served with and under him for his kindliness, thoughtfulness, and consideration ; and

WHEREAS, His training in the art of medicine taught him the necessity for sound, basic, scientific approach to the many problems confronting those who administer the wild life and fisheries of California ; and

WHEREAS, He encouraged and fostered the training of the scientific staff in the Division of Fish and Game which has brought great credit to it ; and

WHEREAS, His knowledge of and enthusiastic participation in the field of fish and game recreation endeared him to the sportsmen of the State of California while his quick grasp of the problems confronting California's great commercial fishing industry contributed greatly to its development ; now, therefore, be it

Resolved by the Fish and Game Commission of the State of California, at its meeting in Los Angeles on July 14, 1944, that it realizes the loss of a great and understanding friend ; and be it further

Resolved, That this resolution be spread upon the minutes of the meeting and that it be published in the Fish and Game Quarterly as an evidence of the respect and esteem in which it held Dr. E. Clarence Moore ; and be it further

Resolved, That the Flag at all facilities of the Fish and Game Commission be flown at half staff on Sunday, July 23, 1944, out of respect for his passing.

REPORTS

FISH CASES

April, May, June, 1944

Offense	Number arrests	Fines imposed	Jail sentences (days)
Abalone: Undersize, removal from shell below high tide, overlimit, fail to show license and abalone on demand.....	105	\$2,880 00	-----
Angling: District 101 no license, use gaff 300 ft. of stream, closed season, no license, near fish ladder, 150 ft. lower side of weir, game fish closed season, night fishing, more than one rod and line, taking fish other than angling, 150 ft. lower side of dam, failure to show license on demand, operating set line, using more than two attractor blades.....	138	2,413 50	-----
Bass, black: Closed season, no license, transport for sale.....	20	560 00	-----
Bass, striped: Failure to liberate from shad nets, use of more than one rod, taking with gill net Mokelumne River closed waters, no license, at night.....	34	815 00	-----
Catfish: Undersize, use of net to take catfish, closed waters.....	2	75 00	-----
Clams: Undersize, refuge.....	13	295 00	-----
Crappie: Closed season, no license, overlimit.....	2	70 00	-----
Commercial fishing: No license, refusal to show records and failure to fill out tags, no record kept of fresh fish bought from commercial fishermen, taking halibut with trammel net District 19-a.....	5	350 00	-----
Operating fish trap.....	2	200 00	-----
Perch: Closed season.....	3	85 00	-----
Salmon: Snagging, taking between sunset and sunrise, night spearing, taking on Sunday District 12b.....	33	1,285 00	-----
Sunfish: Closed season, no license.....	15	422 50	12
Trout: Closed season, no license, overlimit, using more than one rod, snagging, gaffing steelhead.....	87	2,107 50	-----
Totals.....	459	\$11,558 50	12

GAME CASES

April, May, June, 1944

Offense	Number arrests	Fines imposed	Jail sentences (days)
Deer: Closed season, female, using artificial light, night hunting, illegal game, spike buck, no license, spotted fawn, killing doe.....	24	\$1,830 00	-----
Deer meat: Closed season, illegal.....	9	875 00	-----
Doves: Closed season.....	1	25 00	-----
Ducks: Overlimit, after sunset, closed season.....	7	1,265 00	-----
Firearms: Refuge.....	5	85 00	-----
Hunting: Refusal to show license on demand.....	1	10 00	-----
Pheasants: Closed season, no license, shooting from public road, shooting from vehicle, no tags, hen pheasant.....	15	690 00	-----
Quail: Closed season, no license.....	2	75 00	-----
Shooting from car.....	1	25 00	-----
Squirrel, grey.....	2	100 00	-----
Trapping for profit: No license.....	1	25 00	-----
Totals.....	68	\$5,005 00	-----

SEIZURES OF FISH AND GAME

April, May, June, 1944

Fish:	
Abalones.....	173
Abalones, black.....	142
Abalones, red.....	334
Bass, black.....	63
Bass, striped, pounds.....	77
Catfish, pounds.....	400
Clams.....	48
Crappie.....	43
Lobster traps.....	16
Perch, saltwater, pounds.....	50
Salmon.....	30
Shad, pounds.....	102
Sunfish.....	175
Sunfish, bluegill.....	35
Trout.....	554
Trout, rainbow.....	386
Trout, rainbow, pounds.....	35
Trout, steelhead.....	20
Trout, steelhead, pounds.....	1
Game:	
Deer.....	5
Deer meat, pounds.....	175½
Doves.....	2
Ducks.....	21
Ducks, drake mallard.....	2
Pheasants.....	4
Pheasants, hen.....	1
Pheasants, male.....	10
Quail.....	1
Rabbits, cottontails.....	11
Squirrels, grey.....	2
Woodduck.....	1

CALIFORNIA FISH AND GAME

FINANCIAL STATEMENT—DIVISION OF FISH AND GAME

Revenue for the Period July 1, 1943, to June 30, 1944, of the Ninety-fifth Fiscal Year

Revenue for Fish and Game Preservation Fund:

License revenue:

1944 series—

Angling	\$303,397 50
Hunting	153 00
Trapping	1 00
Fish packer and shellfish dealer	255 00
Deer tags	17 00
Fish tags	2,540 00
Game tags	52 05
Market fisherman	64,640 00
Fish importers	65 00
Fish party boat permits	175 00
Fish breeder	205 00
Game breeder	2,795 00
Kelp license	50 00
Game management—Licenses	90 00
Game management—Tags	5 25

Total, 1944 series	\$374,440 80
--------------------------	--------------

1943 series—

Angling	\$598,454 50
Hunting	551,553 00
Commercial hunting club	750 00
Commercial hunting club operator	205 00
Trapping	1,552 00
Fish packer and shellfish dealer	990 00
Deer tags	147,746 00
Fish tags	1,540 00
Game tags	66 81
Market fisherman	49,740 00
Fish importers	5 00
Fish party boat permits	60 00
Fish breeder	25 00
Game breeder	300 00
Kelp license	10 00
Game management—Licenses	20 00
Game management—Tags	4 29
Antelope permits	2,500 00
Pheasant tags	121,186 00
Elk permits	750 00

Total, 1943 series	\$1,477,458 10
--------------------------	----------------

1942 series—

Angling	\$625 00
Hunting	14,027 50
Deer tags	73 00
Fish tags	20 93
Game tags	

Total, 1942 series	\$14,746 43
--------------------------	-------------

Total, licenses, 95th fiscal year	\$1,866,645 33
---	----------------

Other revenue:

Court fines	\$38,189 36
Deer meat permits	4,263 00
Lease of kelp beds	1,334 50
Publication sales	53 99
Fish packers tax	291,229 66
Kelp tax	1,057 30
Salmon packers tax	33,933 60
Miscellaneous revenue	18,826 32

Total, other revenue	\$388,887 73
----------------------------	--------------

Grand total, revenue all years, Fish and Game Preservation Fund	\$2,255,533 06
---	----------------

FINANCIAL STATEMENT—DIVISION OF FISH AND GAME

Expenditures for the Period July 1, 1943, to June 30, 1944, of the Ninety-fifth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Education and public information.....	\$3,435 00	\$187 43	-----	-----	\$3,622 43
Executive.....	7,379 92	3,715 93	-----	\$2 77	11,098 62
Library.....	2,255 00	74 03	-----	339 09	2,668 12
Exhibits.....	-----	96 59	-----	-----	96 59
Fish and game magazine.....	-----	2,307 28	-----	-----	2,307 28
Office.....	10,274 00	70,705 95	-----	332 22	81,312 17
Total Administration.....	\$23,343 92	\$77,087 21	-----	\$674 08	\$101,105 21
Patrol and Law Enforcement:					
Cannery inspection.....	\$21,439 82	\$946 28	-----	-----	\$22,386 10
Executive.....	16,755 00	2,626 50	-----	\$18 54	19,400 04
Land patrol.....	268,239 28	92,854 32	-----	454 83	361,548 43
Marine patrol.....	47,501 03	25,628 39	-----	5,228 18	78,357 60
Office.....	9,991 50	1,334 56	-----	7 38	11,333 44
Pollution patrol.....	2,130 00	1,131 59	-----	-----	3,261 59
Total Patrol and Law Enforcement.....	\$366,056 63	\$124,521 64	-----	\$5,708 93	\$496,287 20
Marine Fisheries:					
Central Valleys Water and Salmon Project.....	\$11,175 50	\$4,929 62	-----	\$92 61	\$16,197 73
Executive.....	8,720 00	923 25	-----	16 06	9,659 31
Fish Cannery audit.....	-----	4,418 11	-----	-----	4,418 11
Laboratory.....	3,877 81	1,756 24	-----	87 62	5,721 67
Mackerel.....	1,385 00	7 70	-----	-----	1,392 70
Office.....	8,569 94	588 27	-----	59 92	9,218 13
Sardines.....	10,991 56	1,318 65	-----	-----	12,310 21
Shark investigation.....	3,425 00	4,981 54	-----	-----	8,406 54
Shell fish and miscellaneous.....	3,275 00	433 73	-----	-----	3,708 73
Statistics.....	18,567 66	8,275 68	-----	7 38	26,850 72
Tuna.....	830 73	179 24	-----	-----	1,009 97
Total Marine Fisheries.....	\$70,818 20	\$27,812 03	-----	\$263 59	\$98,893 82
Fish Conservation:					
Biological survey.....	\$10,491 84	\$809 43	-----	-----	\$11,301 27
Executive.....	11,840 00	1,068 47	-----	-----	12,908 47
Field Supervision.....	3,780 00	689 96	-----	-----	4,469 96
Fish food unallocated.....	-----	64,208 49	-----	-----	64,208 49
Fish planting.....	1,075 00	1,327 80	-----	\$21 53	2,424 33
Fish rescue.....	11,179 50	3,021 10	-----	-----	14,200 60
Office.....	8,862 95	425 72	-----	-----	9,288 67
Operating expense unallocated.....	-----	235 15	-----	-----	235 15
Pollution inspection.....	4,080 00	861 84	-----	33 31	4,975 15
Statistical.....	-----	305 79	-----	-----	305 79
Structural maintenance.....	-----	140 82	-----	-----	140 82
Alpine Hatchery.....	450 00	10 35	-----	-----	460 35
Arrowhead Lake Egg Collecting Station.....	-----	31 30	-----	-----	31 30
Basin Creek Hatchery.....	5,813 34	982 94	-----	-----	6,796 28
Benbow Dam Experiment Station.....	1,422 50	212 66	-----	-----	1,635 16
Black Rock Springs Ponds.....	-----	108 99	-----	-----	108 99
Bogus Creek Egg Collecting Station.....	-----	85 00	-----	-----	85 00
Brookdale Hatchery.....	6,631 85	2,062 77	-----	2 01	8,696 63
Burney Creek Hatchery.....	5,887 95	701 98	-----	-----	6,589 93
Central Valley Hatchery.....	4,685 00	2,440 33	-----	5 41	7,130 74
Claremont.....	410 00	-----	-----	-----	410 00
Copco Egg Collecting Station.....	104 88	91 18	-----	-----	196 06
Coy Flat.....	645 00	105 19	-----	-----	750 19
Fall Creek Hatchery.....	6,651 51	607 61	-----	-----	7,259 12
Feather River Hatchery.....	3,949 74	323 89	-----	-----	4,273 63
Fillmore Hatchery.....	16,498 78	8,084 13	-----	648 69	25,231 60
Fishing Creek Hatchery.....	-----	150 00	-----	-----	150 00
Hot Creek Hatchery.....	17,477 33	13,712 98	-----	130 06	31,320 37
Kaweah Hatchery.....	4,422 30	1,728 64	-----	-----	6,150 94
Kern Hatchery.....	3,104 66	1,160 09	-----	-----	4,264 75
Kings River Hatchery.....	5,655 74	1,465 86	-----	-----	7,121 60
Klamathon Egg Collecting Station.....	-----	4 32	-----	-----	4 32
Lake Almanor Hatchery.....	6,246 71	1,431 28	-----	11 79	7,689 78
Mad River Egg Collecting Station.....	933 72	-----	-----	-----	933 72
Madera Hatchery.....	1,251 14	543 45	-----	-----	1,794 59
Mt. Shasta Hatchery.....	43,478 61	11,528 56	-----	71 11	55,078 28
Mt. Tallac Hatchery.....	2,178 34	2,193 21	-----	23 10	4,394 65
Mt. Whitney Hatchery.....	20,979 94	14,756 29	-----	51 63	35,787 86
Prairie Creek Hatchery.....	5,659 29	2,206 40	-----	5 13	7,870 82
Rearing Reservoir.....	-----	1 00	-----	-----	1 00
Rush Creek Egg Collecting Station.....	318 49	7 70	-----	-----	326 19

FINANCIAL STATEMENT—DIVISION OF FISH AND GAME

Expenditures for the Period July 1, 1943, to June 30, 1944, of the Ninety-fifth Fiscal Year—Continued

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Fish Conservation—Continued:					
Salt Springs.....	\$58 50				\$58 50
San Lorenzo Egg Collecting Station.....		\$115 56			115 56
Sequoia Hatchery.....	3,231 05	2,030 98		\$148 21	5,410 24
Shasta River Egg Collecting Station.....	155 00	133 24			288 24
Snow Mountain Egg Collecting Station.....	2,165 33	326 06			2,491 39
Tahoe Hatchery.....	7,936 04	2,599 57		11 31	10,546 92
Yosemite Hatchery.....	4,769 99	724 99		2 31	5,497 29
Yuba River Hatchery.....	3,190 00	212 22			3,402 22
Total Fish Conservation.....	\$237,672 02	\$145,975 29		\$1,165 60	\$384,812 91
Engineering:					
Engineering.....	\$8,112 20	\$2,344 00		\$4 61	\$8,460 81
Executive.....	5,040 00	1,072 38			6,112 38
Inspecting fish screens.....	3,683 66	1,262 04			4,945 70
Office.....	1,860 00	77 07			1,937 07
Total Engineering.....	\$16,695 86	\$4,755 49		\$4 61	\$21,455 96
Game Conservation:					
Duck rescue.....	\$495 97	\$389 25			\$885 22
Elk Refuge.....	1,070 00	620 77			1,690 77
Executive.....	11,220 00	2,487 24			13,707 24
Game management.....	8,279 49	4,904 73		\$35 00	13,219 22
Grey Lodge Refuge.....	4,063 77	598 47		10 87	4,673 11
Honey Lake Refuge.....	1,129 02	1,112 46		482 47	2,723 95
Imperial Refuge.....	2,460 00	199 48			2,659 48
Los Banos Refuge.....	4,253 01	1,293 65		620 59	6,167 25
Office.....	4,586 68	300 73			4,887 41
Predatory Animal—hon hunting.....	5,745 00	6,231 96			11,976 96
Predatory Animal—trapping.....	49,779 37	16,305 40			66,084 77
Research.....	8,219 83	2,105 44		61 10	10,386 37
Statistics.....		8 19			8 19
Suisun Refuge.....	5,089 59	1,164 06			6,253 65
Winter feeding and salting of game.....		1,571 01			1,571 01
Total Game Conservation.....	\$106,391 73	\$39,292 84		\$1,210 03	\$146,894 60
Game Farms:					
Castaic Farm.....	\$1,860 00	\$151 42			\$2,011 42
Executive.....	4,640 00	307 08			4,947 08
Fresno farms.....	3,334 79	1,446 21			4,781 00
Game Bird Distribution—Los Serranos.....		76 68			76 68
Game Bird Distribution—Yountville.....		81 30			81 30
Game management.....		38 44			38 44
Los Serranos game farm.....	9,905 24	5,770 06			15,675 30
Office.....	1,590 00	199 60			1,789 60
Redding farm.....	2,150 00	905 69			3,055 69
Sacramento State Farm.....	2,768 34	876 49			3,644 83
Willows.....	2,574 64	616 04			3,190 68
Yountville boarding house.....	355 48	251 90			607 38
Yountville game farm.....	14,545 62	8,719 64			23,265 26
Total Game Farms.....	\$43,724 11	\$19,440 55			\$63,164 66
Licenses:					
Executive.....	\$4,840 00	\$146 10			\$4,986 10
License distribution.....	21,389 71	101,213 43			122,603 14
Office.....	2,100 00	1,378 98			3,478 98
Total Licenses.....	\$28,129 71	\$102,738 51			\$130,868 22
Grand total.....					\$1,443,482 58

INDEX TO VOLUME 30

A

- Acacia*, 137
 Airplane, for counting antelope, 235-237
 Alamo Canal, 117, 119, 148, 168, 176, 197
 River, 115, 143, 148, 149, 152, 156, 159,
 164, 165, 166, 172, 174, 177, 184
 Alderfly, 140
 Algae, 140, 153, 160, 162, 178
 blue green, 138, 166
 filamentous, 141, 151; green, 84, 158,
 171
 green, 138, 166
 marine, 212
 All American Canal, 118, 119, 127, 181,
 182, 183, 186, 197
Alosa sapidissima, 6, 9, 10, 15, 20, 178
 Ameiuridae, 144, 155-161
Ameiurus, 155, 180, 195
 melas, 160
 catulus, 160
 natalis, 159-160
 natalis, 159
 nebulosus, 160
 Amphipod, 140
Anarrhichthys ocellatus, 49, 50, 51
 Anchovy, 16, 147-149
 Angora Lake, 93
Antelope americana, 221
 Antelope in California, prong-horned, 221-
 241
Antilocapra americana, 221
Ardea herodias treganzai, 143
 Arizona Game and Fish Commission, 111,
 112, 195, 203
 Arrowhead, Lake, 92
 Arrowweed, 137, 194
Atriplex, 137, 229
 Avitaminosis in trout, 44; in foxes, 44

B

- Baccharis glutinosa*, 137
 Backswimmer, 141, 158, 168, 170, 171,
 173, 176
 Badger, fur catch, 242
 Ballard Reservoir, rehabilitation of, 61
 Barnhart, Percy S., and Carl L. Hubbs,
 Record of the oilfish (*Ruvettus preti-*
 osus) in California, 52-53. Also see
 Hubbs, Carl L.
 Bass, 130, 139, 141, 171, 174-177, 183, 189,
 192, 197, 198, 199, 204; fishery, 110,
 168, 171; fishing spots, Colorado
 River, 187; season, 206; spawning
 areas, 202, 206; waters, 153, 174-177
 largemouth, 130, 132, 135, 141, 142, 144,
 145, 194, 195
 warmouth, 172-173

- Bear, eye worm infection in, 58
 grizzly, 98-100
 Beetle, 141, 176
 aquatic, 171, 173
 hydrophilid, 148
 larvae, 83, 84
 Benson, Seth B., A "specimen" of grizzly
 bear from Alameda County, Califor-
 nia, 98-100
 Big horn sheep, 233
 Bill Williams River, see Williams River,
 Bill
Black-spotted trout in Blue Lake, Cali-
fornia, 22-42
 Blennioid fishes in southern California, ex-
 tensions of range for, 49-51
 Blood-worm, 82
 Blue darter, 74
 Blue Lake, California, black-spotted trout
 in, 22-42; the bottom fauna of, 86-94
 Bony-tail, 145, 153-154
Bottom fauna of Blue Lake, California,
the, 86-94
 Boulder Canyon Project, 110
 Boulder Dam, 110, 115, 122, 123, 124, 127,
 128, 132, 133, 134, 135, 140, 144, 150,
 154, 155
 Buffalo, local name for suckers, 150-151
 fish, 177, 178, 199
 carp, 177
 Bullhead, 155, 160, 199, 200, 206
 black, 160
 northern, 160
 southern, 160
 brown, 160-161
 native, 159-160
 yellow, 141, 159-160
 northern, 159
 Bulrush, 129, 138, 139, 158
 Bur-sage, 137

C

- Cactus, 136
 Caddice pupae, 81
 Caddisfly, 141, 171
 larvae, 140, 141, 158, 173
 Calhoun, A. J., Black spotted trout in Blue
 Lake, California, 22-42; The bottom
 fauna of Blue Lake, California, 86-94
Cambarus, 141, 178
 Camelback, 150-151
Carassius auratus, 177
 Carp, 54, 56, 135, 138, 141, 143, 144, 151-
 153, 163, 177, 178, 183, 191, 199, 204,
 206
 cow, 163-167
 fishing, 149
 mirror, 152

- Cat, eye worm infection in, 58
house, 242
ring-tailed, fur catch, 242
- Catfish, 130, 135, 142, 143, 150, 155-161,
187, 191, 196, 197, 204
blue, 155-159
bullhead, 195
channel, 141, 145, 155-159, 160, 176, 183,
184, 185, 192, 195, 199, 200, 201, 206
southern, 155-159
spotted, 155-159
square-tailed, 160-161
- Catostomidae, 144, 150-151
Catostomus latipinnis, 143, 151
- Catsclaw, 137
- Cattail, 129, 138, 139, 140, 160
- Cebidichthys violaceus*, 49
- Census methods, antelope, 235-237
- Centrarchidae, 144, 167-177
- Centrarchid, 189
- Chapman, Wilbert McLeod, The comparative osteology of the herring-like fishes (*Clupeidae*) of California, 6-21
- Char, 213
- Chemehuevi Valley, 121
- Chicken, eye worm infection of, 59
- Chironomid, 25, 82, 83, 84, 85, 87, 88, 89,
90, 91, 93, 140, 141, 158, 168, 170, 171
173, 176
- Chironomus* sp., 87, 88, 89
near *cristatus*, 87, 88, 89, 90, 91, 93
tentans, 93
- Chub, 54; poisoning of, 61
- Civet cat, fur catch, 242
- Cladocera, 141, 168, 171
- Cladocerans, 140, 141, 166, 170
- Clam, 140
- Clark, Milton S., In memoriam, 215
- Clear Lake, 61-62
- Clinch River, 146
- Clupea pallasii*, 6, 8, 12, 16, 17, 19
- Clupeidae, 6-21
family, 18
- Clupeoid, 13
- Clupeoidei, suborder, 18
- Cockroach, 59
- Coachella Valley, 119, 182
- Coleoptera, 141, 171
- Colorado River, Aqueduct, 120, 121, 124,
182, 183, 197
District, 197, 203
Indian Reservation, 119, 120, 182, 183
Lower, the fishery of, 109-211
- Comparative osteology of the herring-like fishes (*Clupeidae*) of California, the, 6-21
- Coon, 179, 242, 244, 245, 246
Pallid, 143
- Copepod, 61, 82, 85, 140, 141
- Copper Basin Reservoir, 184, 185, 186
- Cormorant, 142
Farallon, 143
- Cottonwood, 137
Lakes, 93
- Cottus*, 55
- Coyote, 228-229, 233, 242, 243, 246
- Crab, 102
- Crappie, 141, 167-168, 192, 194, 195, 196,
197, 199, 200, 206
black, 141, 167-168, 195
white, 141, 167-168, 195
- Crayfish, 141, 142, 160, 176, 178
- Creosotebush, 136
- Croppie, 167-168
- Curtis, Brian, Twenty-five years ago in California Fish and Game, 62-63, 213-214, 247-248
- Cyprinidae, 54, 144, 150, 151-155
- Cyprinodon*, 163
macularius, 148, 161-162
salinus, 162
- Cyprinodontidae, 144, 161-162
- Cyprinus carpio*, 151-153

D

- Dam, effect on Colorado River fishery, 181-186
- Damselfly, 141, 158, 168, 173
- Daphnia, 82, 85, 141
- Davis Dam, 124
- Debris, food of catfish, 158
- Deer, eye worm infection in, 58-59
- DeLarge, Richard, In Memoriam, 103
- Desmids, 166
- Destruction of surfgrass, *Phyllospadix*, in southern California in the summer of 1943. (Note), 212
- Detritus, 141, 158
- Diamond-back terrapin introduced into California. (Note), 101-102
- Diatom, 151, 166
- Dill, William A., The fishery of the Lower Colorado River, 109-211
- Dipterous larvae, 163
- Ditch grass, 138
- Diversion, effect on Colorado River fishery, 181-187
- Dog, eye worm infection in, 58
for hunting quail, 74, 75, 76, 78, 79
vs. antelope, 228
- Drum, 178

E

- Eagle, hunting antelope, 229
- Eel, 49, 50
wolf, 50-51
- Effect of hunting on a valley quail population, 71-79
- Elopidae, 144, 147-149
- Elops affinis*, 147-149
- Entomostraca, 163
- Ephemerida, 141, 158
- Extensions of range for blennioid fishes in southern California, 49-51
- Eye worm (*Thelazia californiensis*) infection in deer in California, 58-60

F

- Federal aid in wildlife restoration, project
California 5-R, a survey of the fur re-
sources of the state of California, 243
Ferguson Lake, 119
Financial statement, 252-255
Fish, ocean, as a trout diet, 43-48
Fish Springs, 162
Fisher, 242
Fishery of the Lower Colorado River,
the, 109-211
Fishing intensity, Colorado River, 187-190
methods, 190-194
Flatfish, 163
Flounder, a trout diet, 43
Flow, Colorado River, 123-129
Food, of Colorado River fish, 139-142, 147,
148, 151, 153, 158, 159-160, 162, 163,
166, 168, 170-171, 173, 176, 177
Crayfish, 178
Food of the black-spotted trout
(*Salmo clarkii henshawi*) in two
Sierra Nevada lakes, 80-85
Fox, grey, 242, 246
kit, 242
red, 242
Franseria, 137
Fresh ocean fish as a trout diet, 43-48
Frog, 142
bull, 142, 143, 178, 179
Fur catch in California, 1940-1941, the,
242-246
Fur Seal Treaty, 6

G

- Gambusia*, 171
affinis, 63
affinus, 161-163
Gammarus, 81, 85, 88, 89, 92, 93
Gar, 147, 178
Gene Wash Reservoir, 184, 185, 186
Gibbonsia metzi, 50
Gibraltar, 193
Gila, 182
Basin, 144, 178
Canal, 119, 186
drainage, 180
River, 118, 120, 122, 123, 127, 141, 161,
168, 170, 171, 173, 175, 176, 197
Gila elegans, 153-154
robusta, 154
Gillichthys, 203
detrusus, 163
mirabilis, 191
Glading, Ben, and Roy W. Saarni. Effect
of hunting on a valley quail population,
71-79
Gobiidae, 144
Goby, 163, 191, 203
Goldfish, 177, 191, 199
Grand Canyon, 114, 116, 125, 156
Granite Creek, 25, 36
Grass, ditch, 138
Magdalena, 166

- Grazing, cattle, 71
Grebe, 142
Grizzly, skull of, 98, 99
A specimen of, 98, 100
Gulf of California, 115, 148, 163, 165
Gun, type preferred for quail, 78-79

H

- Hake, a trout diet, 43
Haslam Slough, 160, 168
Haughtelin Lake, 117, 118, 135, 140, 152,
159, 165, 167, 168, 169, 170, 171, 176,
178, 188
Havasu Lake, 120, 121, 122, 124, 126, 128,
132, 134, 135, 138, 140, 150, 152, 155,
156, 157, 158, 159, 167, 168, 172, 174,
175, 177, 180, 181, 187, 188, 196, 197
removal of fish from, 184-186
Hawk, 74
Cooper's, 74, 79
Hayfield Reservoir, 185
Headgate Rock Dam, 120, 151, 160, 168,
179, 181
Heenan Lake, 38, 39, 80, 81, 84, 85
Hellgramite, 140
Herman, Carlton M., Eye worm (*Thelazia
californiensis*) infection in deer in
California, 58-60
Heron, 142, 143
blue, 143
Herring, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16,
17, 19
-like fishes (*Clupeidae*) of California,
the comparative osteology of, 6-21
thread, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17,
18, 20
Hesperoleucus symmetricus reported from
Clear Lake, Lake County, California,
(Note), 61-62
Hesperoleucus venustus, 62
Heterostichus rostratus, 50
Hexamita, 43, 45, 46
(*Octomitus*), 45
Horse meat as a trout diet, 43, 44, 45
Hot Creek Hatchery, 95, 96
Hubbs, Carl L., and Percy S. Barnhart,
Extensions of range for blennioid
fishes in southern California, 49-51.
Also see, Barnhart, Percy S.
Hunter, J. S., In memoriam, Milton S.
Clark, 215
Hunting, effect on a valley quail popula-
tion, 71-79
Huro, 169
salmoides, 174-177
Hyallala, 92, 93
Hydracarina, 141, 171
Hydrachnid, 89, 93
Hymenoptera, 176

I

- Ictalurus lacustris punctatus*, 155-159
Ictiobus sp. 178

- Imperial Canal, 117
 Dam, 110, 118, 119, 127, 128, 138, 148, 163, 164, 168, 169, 174, 175, 176, 177, 181, 196, 197, 202
 desilting at, 186
 Reservoir, 129
 State Game Refuge, 159
 Valley, 115, 116, 119, 142, 143, 155, 158, 161, 163, 164, 172, 173, 174, 177, 182, 184, 187, 193, 197, 200
 In Memoriam—Richard DeLarge, 103; Milton S. Clark, 215; E. Clarence Moore, 249
 In the service of their country, 2, 70, 108, 220
 International Boundary, 164
 Isopoda, 141, 158
- J
- Jay, 74
- K
- Kelp, beds, 49-50
 blenny, 50
 eel, 50
 meal, in trout diet, 45, 47
 Killifish, 161-162
 desert, 161-162
 Kingfisher, 142, 143
Kinosternon sonoriense, 142, 179-181
- L
- Laguna Dam, 117, 118, 128, 144, 148, 154, 157, 164, 165, 176, 178, 180, 181, 187, 193, 197
Larrea, 137
 Lawrence, Barbara, Skull of a California grizzly (note), 98, 99
Lepomis, 174
cyanellus, 172-173
macrochirus, 169-171
Leuciscus caurinus, 4
 Lewis, R. C., Selective breeding of rainbow trout at Hot Creek Hatchery, 95-97
 Liver, as a trout diet, 43, 44, 45, 47, 48
Lorphortyx californica, 71
 Lower Colorado River, the fishery of, 109-211
- M
- McLean, Donald D., The prong-horned antelope in California, 221-241
 Man, eye worm infection in, 58
 Marten, 242, 244
 Martinez Lake (Arizona), 119, 129, 159, 174, 177, 188, 197
 Mathews Lake, 182, 185
 Mayfly, 83, 84, 140, 141, 142, 168, 171
 Mead Lake, 110, 119, 124, 125, 140, 144, 150, 154, 162, 171, 176, 198
 Merganser, 142, 143
Merluccius productus, 43
 Mesilla Valley, New Mexico, turtles in, 180
 Mesquite, 137
- Metropolitan Water District of Southern California, 120, 121, 184, 185
Micropterus, 169
dolomieu, 174
 Middle Creek, 36, 37
 Midge, 140, 141, 158, 171
 Millerton Lake, 121
 Mink, 242, 246
 Minnow, 40, 61, 80, 83, 84, 85, 143, 145, 150-155, 168, 195
 desert, 148, 161-162
 mosquito, 162-163
 top, 63, 162-163
 Mite, water, 141
 Mittry Lake, 118
 Mohave Canyon, 120, 122
 Indians, fishing methods, 190
Montereya recalva, 49
 Moore, E. Clarence, in memoriam, 249
 Mosquitofish, 63, 141, 142, 171, 176, 191
 western, 162-163
 "Moss," carp grazing on, 138; fish packed in, 191
 Mt. Shasta Hatchery, 43, 44, 45, 47
 Mudcat, 159-160
 Mud-sucker, 191
Mugil cephalus, 163-167
 Mugilidae, 144, 163-167
 Mullet, 140, 141, 143, 149, 151, 163-167, 183, 184, 191, 199, 206; fishery, 111; fishing in Salton Sea, 153
 bay, 118, 181, 197
 common, 163-167, 192
 grey, 193
 Murphy, Garth, *Hesperolencus symmetricus* reported from Clear Lake, Lake County, California, 61-62
 Muskrat, 242, 246
 Trappers, 244
 Mussel, 102, 140
Mylocheilus lateralis, 4
Mylopharodon conocephalus, 62
- N
- Najas*, 121, 139, 140, 158, 160
marina, 138
 Needles Boat Landing, 121, 122, 132, 134, 140, 187, 188
 Nematodes, 144
 Nepidae, 171
 Neuroptera, 140
 New River, 115, 143, 149, 156, 164, 165, 166, 174, 184
Nitella, 86
 Norris Reservoir, Tennessee, 132
 North Creek, 36, 37
 North Gila, 182
 Irrigation District, 118, 184
 Northend Dam, 166
 Notonectids, 81, 141, 171
- O
- Octomitus*, 45
Odocoileus hemionus columbianus, 58
 Odonata, 141, 158

Oilfish, 52-53
 Oligochaetes, 140
 Ooze, food of fish, 141, 158
Opisthonema libertate, 6, 10, 13, 14, 17, 20
 Opossum, 242
 Osteology of the herring-like fishes
 (*Clupeidae*) in California, 6-21
 Ostracod, 140, 168, 171
 Otter, river, 242
 Owl, 74

P

Palo Verde Irrigation District, 119, 130,
 136, 182, 201
 Lagoon, 192
 Slough, 119, 135, 140, 141, 150, 193
 Valley, 197
 Panamint Indian, 162
Pantosteus-Santa Ana, 4
 Paralichthyidae, 144
Paralichthys aestuarius, 163
 Parker Dam, 110, 120-122, 124, 127, 128,
 130, 132, 133, 134, 145, 181, 185, 186,
 196
 Paul Lake, 92
 Pelican, 142
 white, 143
Pelecanus erythrorhynchos, 143
Perca flavescens, 178
 Perch, 169-173
 bluegill, 169-171, 196
 sun, 169-173
 yellow, 178
Phalacrocorax auritus albociliatus, 143
Phyllospadix, 212
 Pike, 147-149, 178
 Pilot Knob Wasteway, 117, 148, 181, 197
 Pinkeye, 58
 Pipe fish, 50
 Planaria, 81
 aquatic, 138-139
 land, 136-137
 Plecoptera, 140
Pluchea sericea, 137
 Poeciliidae, 144, 162-163
 Poisoning, chubs in Ballard Reservoir, 61
Pomocis, 174
 annularis, 167-168
 nigro-maculatus, 167-168
Populus fremontii, 137
Potamogeton, 138
 Porpoise, 6
 Predation, on fish, 142-144
 Pribilof Islands, 6
Procladius sp., 87
Procyon lotor pallidus, 143
 Prong-buck, 221
 Prong-horned antelope in California,
 the, 221-241
Prosopis, 137
 Protozoa, 166
 Psectrocladius, 89
Ptychocheilus lucius, 154-155
 oregonensis, 154
 grandis, 154

Q

Quail, valley, 71-79

R

Racoon, *see* Coon
Rana catesbeiana, 142, 179
 Record of the oilfish (*Ruvettus preti-
 osus*) in California, 52-53
 Redhorse, 178
 Regulations, Colorado River, 195-204
 Reports, 64-65, 104-105, 216-217, 250-251
Rhinichthys oscula, 40, 80, 82, 83, 84
 Ring-tailed cat, 242
Roccus saratilis, 178
 Rock Dam, 119
 Rockfish, 52
 Rockwood Gate, 117
 Roosevelt Lake, Arizona, 178
 Round-tail, 153-154
 Round-worm, in viscera of largemouth
 bass, 144
Ruppia, 138
Ruvettus pretiosus, 52-53
 tydemani, 52

S

Saarni, Roy W.; *see* Glading, Ben
Salix, 137
Salmo aqua-bonita, 213
 clarkii, 213
 henshawi, 22, 80-85, 86
 pleuriticus, 149-150, 213
 gairdnerii, 149-150, 213
 henshawi, 22
 roosevelti, 213
 seleniris, 213
 Salmon, 5, 6, 154-155, 184, 202
 chinook, 6
 Colorado River, 145, 154-155
 Pacific, 35
 silver, 6
 white, 154-155
 Salmonidae, 144, 149-150
 Salt River, 178
 Saltbush, 137
 Salt-cedar, 137
 Salton Sea, 111, 115, 143, 144, 148, 149,
 150, 153, 154, 155, 161, 162, 163, 164,
 165, 166, 167, 178
 Sink, 115
 Sandrat, 242
 San Joaquin Experimental Range, 71-79
 Sardine, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16,
 17, 19
Sardinops caerulea, 6, 8, 10, 12, 14, 19
 Saugus, in Lake Erie, 146
Scirpus, 138
 Scheffer, Victor B., Destruction of surf-
 grass, *Phyllospadix*, in southern Cali-
 fornia in the summer of 1943, 212
 Scud, 61, 81, 82, 84, 85
 Sculpin, 49

- Seal, fur, 6
 hair, 6
 Sea-gull, 6
 Sea-lion, 6
Sebastodes, 52
 Seepwillow, 137
 Selective breeding of rainbow trout at Hot Creek Hatchery, 95-97
 Shad, 6, 7, 8, 9, 10, 13, 14, 15, 16, 18, 20, 178
 Shapovalov, Leo, The tench in California, 54-57
 Shark, 6
 Sheep, eye worm infection in, 58
 Shrimp, freshwater, 61
 fishery, 62-63
 Silt, Colorado River, 125-129; desilting, 186
 Siphon Drop, 186
 Skull of a California grizzly (note), 98-99
 Skunk, striped, 242, 246
 Snail, 139, 140
 Snake, desert garter, 142
 Snyder, 1867-1943, John Otterbein, 3-5
 Sonoyta River, 161
 South Creek, 36
 Spawning, trout in Blue Lake, 22-42; season, Colorado River, 130, 132
 "Specimen" of grizzly bear from Alameda County, California, a (note), 98-100
 Spermatophytes, 140
 Spider, 141, 158, 176
 Squawfish, Colorado River, 145, 154-155
 Statistical methods for determining fur catch, 243-245
 Stickleback, as a mosquito destroyer, 63
Stizostedion canadense, 146
 Stocking, Colorado River, 194-195
 Stonefly, 140
 Sucker, 150-151
 flannel-mouthed, 151
 humpback, 141, 145, 150-151, 178
 razorback, 150-151
 Sunfish, 130, 135, 139, 142, 167-177, 183, 184, 197, 199, 200, 203, 206
 bluegill, 132, 141, 142, 158, 168, 169-171, 172-173, 176, 185, 191, 192, 194, 195, 200
 green, 141, 163, 169, 171, 172-173, 185, 191, 195
 Surfgrass, 212
Syngnathus californiensis californiensis, 50
- T**
- Taft, A. C., Diamond-back terrapin introduced into California, 101-102; In memoriam, Richard De Large, 103; John Otterbein Snyder: 1867-1943, 3-5
Tamarix, 137
Tanytarsus sp., 89
 Tarpon, 147-149
 Temperature, Colorado River, air, 129; water, 129-134
 Tench in California, the, 54-57
 Ten-pounder, 147-149
 Tern, 142
 Terrapin, diamond-back, 101-102
Thamnophis marcianus, 142
Thelazia californiensis, 58-59
 Tigris, 125
Tinca tinca, 54
 Toad, 142
 Trapper, 242-246
 Trichoptera, 82, 83, 141, 158
Trionyx emoryi, 142, 179-181
ferox, 142
s. spinifera, 142
 Trout, 134, 149-150, 184, 202, 204, 213; eggs, 82, 136; fresh ocean fish as a diet, 43-48; fishing restored to Modoc County reservoir (note), 61
 black-spotted, 22-42, 80-85, 86
 brown, 213, 214
 cutthroat, 22, 35, 36, 40, 213
 Colorado River, 149-150, 213
 Dolly Varden, 213
 eastern brook, 213
 Gila, 153-154
 golden, California, 213
 South Fork of Kern, 213
 Volcano Creek, 213
 Kern River, 213
 loch leven, 213, 214
 McCloud River, 213
 mackinaw, 213
 Piute, 213
 rainbow, 43-47, 61, 95-97, 149-150, 213, 214
 Shasta, 213
 steelhead, 5, 213
 Verde, 153-154
 Tubificids, 90, 91
 Tubifex worms, 87, 88, 93
 Tuna, 6
 Turbellarians, 89, 93
 Turtle, in Rio Grande, 180
 Emory's soft-shelled, 142, 143, 179-181
 Sonoran mud, 142, 179-181
 Twenty-five years ago in "California Fish and Game," 62-63, 213-214, 247-248
 Twining, Howard, The fur catch in California, 1940-1941, 242-246
Typha, 138
- U**
- Ulvicola sanctae-rosae*, 49-50
 Upper Blue Lake; see Blue Lake
Ursus californicus, 100
colusus, 100
tularensis, 100
- V**
- Vitamin, in trout diet, 44-48

W

Wales, J. H., Fresh ocean fish as a trout diet, 43-48; trout fishing restored to Modoc County reservoir, 61
 Weasel, 242
 West Creek, 25, 36, 37
 West Main Ditch, 158
 Whale, 6
 Wildcat, 242, 243, 246
 Willow, 137
 Williams River, Bill, 120, 122, 123, 124, 127, 134, 135

X

Xenogramma carinatum, 52-53
Xyrauchen texanus, 143

Y

Yellowbelly, 159-160
 Yuma Club, 156
 Yuma Main Canal Wasteway, 118, 183
 Yuma Project, 119, 164, 179, 182, 183, 192
 Yuma Project Canal, 118
 Yuma Valley Rod and Gun Club, "prize fish contest," 156, 174

(Continued from inside front cover)

BUREAU OF ENGINEERING

JOHN SPENCER, Chief.....	San Francisco
Clarence Elliger, Assistant Hydraulic Engineer.....	San Francisco
Samuel Kabakov, Junior Civil Engineer.....	San Francisco

BUREAU OF LICENSES

H. R. DUNBAR, Chief.....	Sacramento
L. O'Leary, Supervising License Agent.....	Sacramento
R. Nickerson, Supervising License Agent.....	Los Angeles
Lorraine Atwood, License Agent.....	San Francisco

ACCOUNTS AND DISBURSEMENTS

D. H. BLOOD, Departmental Accounting Officer.....	Sacramento
---	------------

BUREAU OF PATROL

E. L. MACAULAY, Chief of Patrol (absent on military leave).....	San Francisco
L. F. CHAPPELL, Chief of Patrol.....	San Francisco

CENTRAL DISTRICT (Headquarters, Sacramento)

C. S. Bauder, Inspector in Charge.....	Sacramento
--	------------

Northern Division

A. A. Jordan, Captain.....	Redding
Jos. H. Sanders, Captain.....	Sacramento
A. H. Willard, Captain.....	Rocklin
E. O. Wraith, Captain.....	Chico
L. E. Mercer, Warden, Butte County.....	Chico
Taylor London, Warden, Colusa County.....	Colusa
Albert Sears, Warden, El Dorado County.....	Placerville
E. C. Vail, Warden, Glenn County.....	Willows
Louis Olive, Warden, Modoc County.....	Alturas
Earl Hiscox, Warden, Nevada County.....	Nevada City
Nelson Poole, Warden, Placer County.....	Auburn
E. J. Johnson, Warden, Plumas County.....	Quincy
Charles Sibeck, Warden, Sacramento County.....	Sacramento
Earl Caldwell, Warden, Shasta County.....	Burney
Brice Hammack, Warden, Siskiyou County.....	Yreka
Fred R. Starr, Warden, Siskiyou County.....	Dorris
R. E. Tutt, Warden, Sierra County.....	Downville
R. W. Anderson, Warden, Tehama County.....	Red Bluff
C. L. Gourley, Warden, Trinity County.....	Weaverville
C. O. Fisher, Warden, Yolo County.....	Woodland
R. A. Tinnin, Warden, Yuba County.....	Marysville
Wm. LaMarr, Warden, Placer County.....	Tahoe City
Rudolph Gerhardt, Warden, Butte County.....	Gridley
K. Langford, Warden, Sutter County.....	Yuba City
Walter Krukow, Warden, Shasta County.....	Redding

Southern Division

S. R. Gilloon, Captain.....	Fresno
John O'Connell, Captain.....	Stockton
R. J. Little, Warden, Amador County.....	Pine Grove
L. R. Garrett, Warden, Calaveras County.....	Murphys
F. A. Bullard, Warden, Fresno County.....	Reedley
Paul Kehrner, Warden, Fresno County.....	Fresno
Lester Arnold, Warden, Kern County.....	Bakersfield
C. L. Brown, Warden, Fresno County.....	Coalinga
Ray Ellis, Warden, Kings County.....	Hanford
H. E. Black, Warden, Madera County.....	Madera
Gilbert T. Davis, Warden, Mariposa County.....	Mariposa
Hilton Bergstrom, Warden, Merced County.....	Los Banos
Wm. Hoppe, Warden, San Joaquin County.....	Lodi
Geo. Magladry, Warden, Stanislaus County.....	Modesto
W. I. Long, Warden, Tulare County.....	Visalia
Roswell Welch, Warden, Tulare County.....	Porterville
F. F. Johnston, Warden, Tuolumne County.....	Sonora
Donald Hall, Warden, Kern County.....	Kernville